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Ojai Meadows Preserve
Habitat Restoration and Flood Control Plan

Prepared For:

THE OJAI VALLEY LAND CONSERVANCY

June 2004

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I. Introduction

The Ojai Valley Land Conservancy has retained Condor Environmental Planning Services Inc. to prepare this habitat restoration and flood control plan for a 57.17 acre property that it owns, known as the Ojai Meadows Preserve.

The Ojai Meadows Preserve is located between the town of Meiners Oaks and the City of Ojai, in the Ojai Valley of Ventura County, California (Maps 1 and 2). The Preserve is bounded by Highway 33 (Maricopa Highway) to the north, Nordhoff High School to the east, Meiners Oak Elementary School and Saint Thomas Aquinas Church to the west and the Taormina community and Besant Road to the south. The Preserve was created by the Ojai Valley Land Conservancy's purchase of two properties: Besant Meadows in 1999 and the Palmer Property in 2000 (Map 2).

Across the highway from the Preserve is the Cuyama Meadow Property which encompasses 15 acres. Although acquisition of this privately-owned parcel is currently being considered, it is not a part of this Restoration and Flood Control Plan. However, the Conservancy does own the Ventura River Preserve, a 1,591 acre property, approximately 0.7 miles to the west, adjacent to and including a portion of the Ventura River. The Ventura River Preserve is also not a part of this Plan, but because of its proximity to the Ojai Meadows Preserve and its shared ownership, it is identified on Maps 1 and 2.

The authors of this report are Elihu Gevirtz, Mary Carroll, Hugo Loaiciga, Bruce Reed, Katrina Burton, and Vince Semonsen. Information about the authors is provided on the following page. **The proper citation of this document is "Condor Environmental Planning Services, 2004. Ojai Meadows Preserve Habitat Restoration and Flood Control Plan. Prepared for the Ojai Valley Land Conservancy."**

A. Authors of this Plan

Elihu Gevirtz

Elihu Gevirtz is the President of Condor Environmental and the Project Manager of this Restoration Plan. He has 15 years experience in project management, habitat restoration and biological surveys. He worked for 10 years as a Senior Planner, Biologist and Project Manager for the Santa Barbara County Planning and Development Department, where he worked on resource protection policies of the Comprehensive Plan, management plans for nature preserves, habitat restoration plans, CEQA guidelines and documents, land acquisition, grant writing and transportation.

Mary Carroll

Mary Carroll, Senior Botanist and Educator for Condor Environmental, has over 25 years of experience conducting botanical field research in southern California. She has a Masters Degree in Botany, and served as the Director of Education at the Santa Barbara Botanic Garden for many years before coming to work for Condor Environmental.

Hugo Loaiciga

Dr. Hugo Loaiciga, Senior Hydrologist and Registered Civil Engineer, has been Professor of Hydrology in the Geography Department of UCSB since 1996. He specializes in watershed hydrology, hydrogeology and planning and has extensive publications and project experience in California and around the world.

Bruce Reed

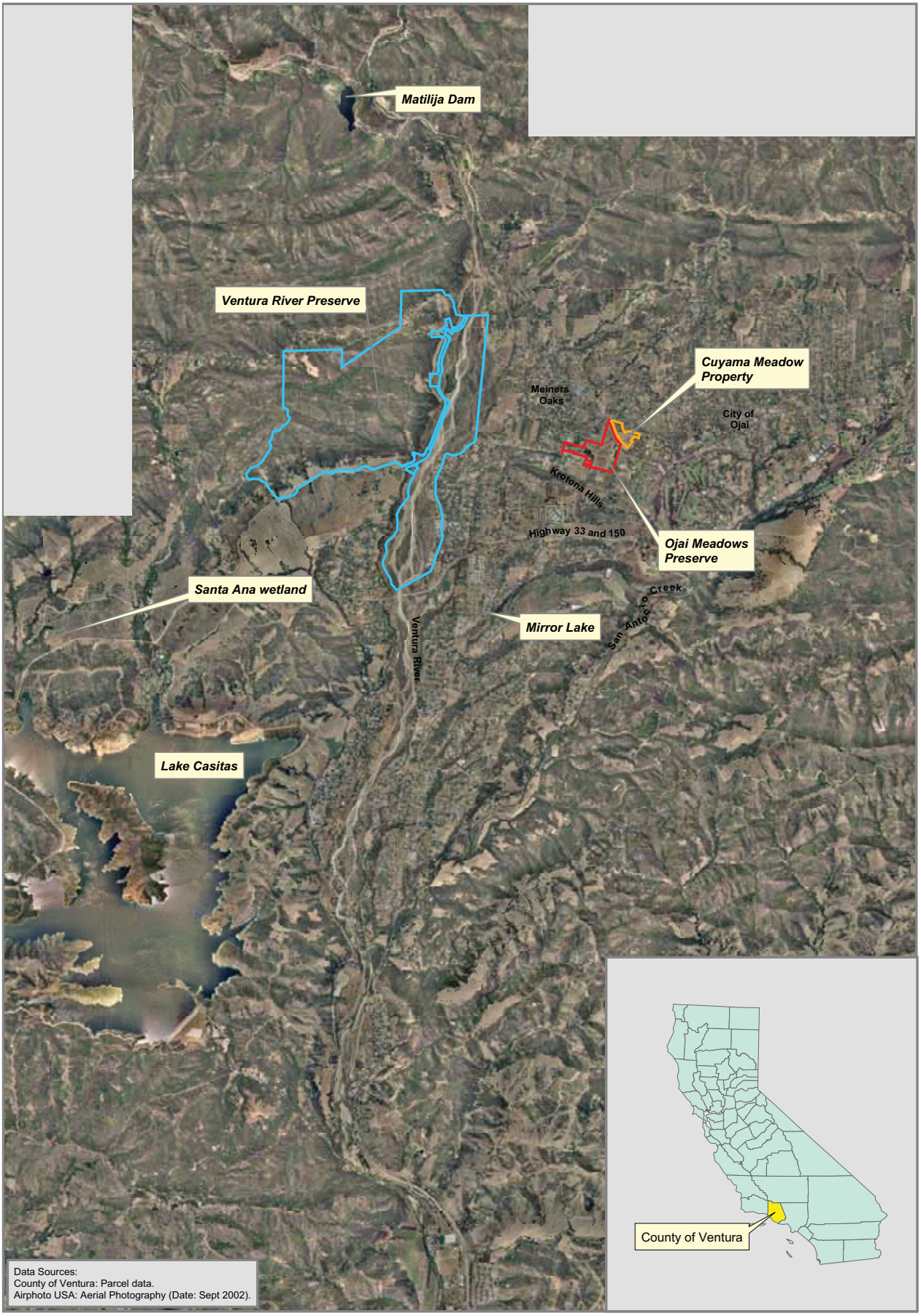
Bruce Reed is an experienced horticulturist who serves as the Nursery Manager at the Santa Barbara Botanic Garden. He has extensive expertise in growing native plants and native plant restoration.

Katrina Burton

Katrina Burton, Biologist and GIS Technician for Condor Environmental, hails from Australia, where she gained expertise in vegetation mapping, biological surveys, and GIS development. At Condor she has worked on numerous environmental planning projects, including mapping and GIS development.

Vince Semonsen

Vince Semonsen, Senior Wildlife Biologist for Condor Environmental, has over 17 years of experience working with sensitive wildlife species and monitoring of large, complex construction projects. He has considerable knowledge of restoration plan development and monitoring implementation.



Project Region

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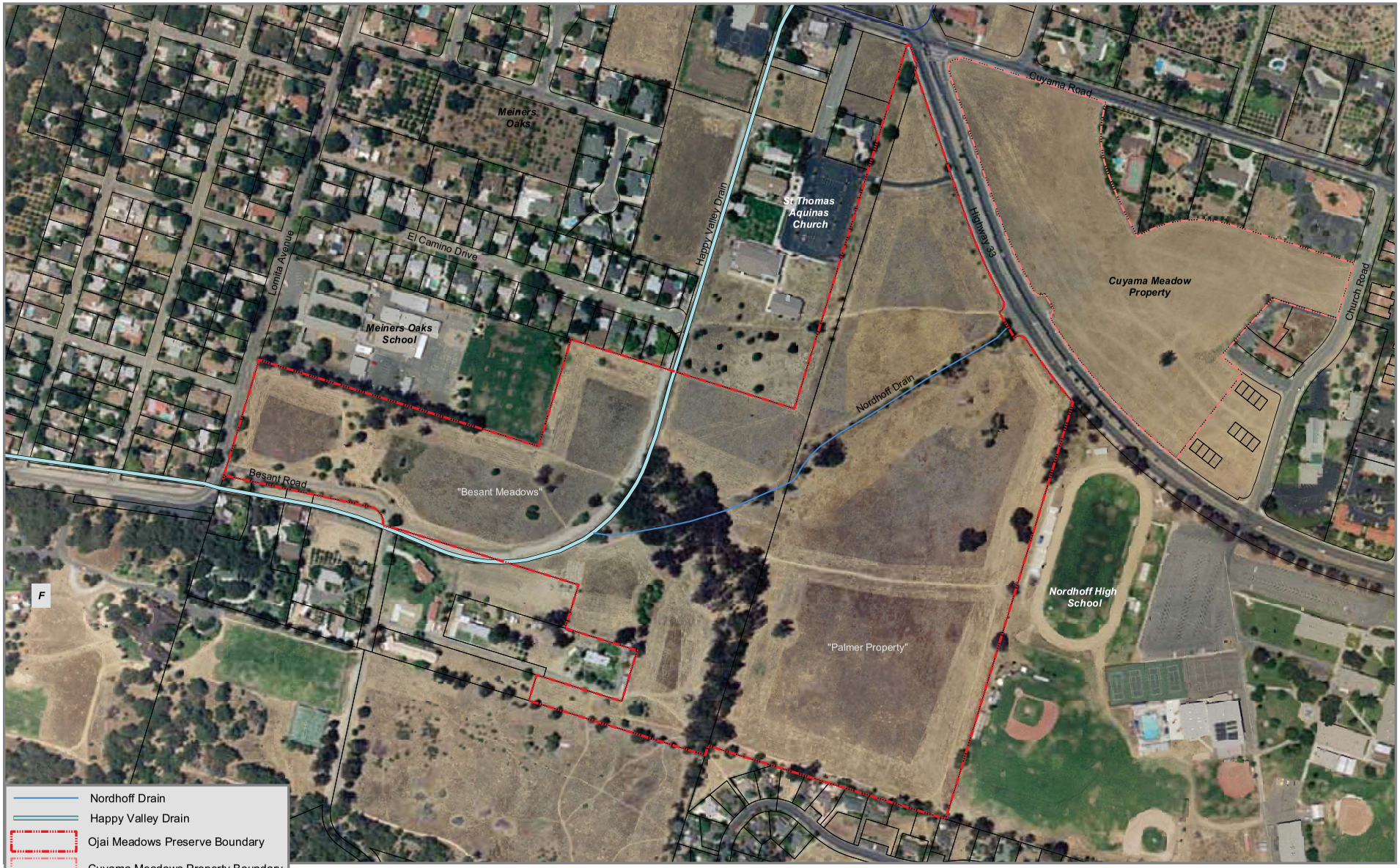
0 2,700 5,400 8,100 10,800 Feet

Ojai Meadows Preserve
Ojai Valley Land Conservancy

Map: 1
May 2004


Meiners Oaks
Cuyama Road
St Thomas Aquinas Church
Happy Valley Drain
Highway 33
El Camino Drive
Lomita Avenue
Cuyama Meadow Property
Church Road
Meiners Oaks School
Nordhoff Drain
Besant Road
"Besant Meadows"
F
Nordhoff High School
"Palmer Property"
Nordhoff Drain
Happy Valley Drain
Ojai Meadows Preserve Boundary
Cuyama Meadows Property Boundary
Parcel Lines
Data Sources:
Ventura County: Parcel Lines
Airphoto USA: Aerial Photography (Date: Sept 2002)
Project Site Area
Condor Environmental Planning Services, Inc.
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0
275
550
1,100
Feet
N
Ojai Meadows Preserve
Ojai Valley Land Conservancy
Map: 2
May 2004

B. Acknowledgements

Jim Engel and Jim Jackson provided invaluable insights and clear direction to the project manager. Mike Krumpschmidt and Carl Thelander shared their knowledge of and enthusiasm for the site and the project's history. Richard Handley provided significant historical accounts of past land use practices, anecdotes from older members of the community, photographs, and recent historical information. Libby Zweig, a resident of Meiners Oaks, provided valuable observations about the extent of flooding and wildlife use of the property. David Laak, Hydrologist for the Ventura County Watershed Protection District, gave generously of his time, knowledge, and resources and was a great help in determining the history of drainage pattern alterations. David Magney graciously and generously shared his botanical expertise of the Ojai Valley regarding several of Ventura County's rare plants. Wayne Ferren provided inspiration and freely shared his great enthusiasm for the diversity of wetlands, and his knowledge of wetlands in the Ojai Valley, including Mirror Lake and his experience in wetland restoration. Esther Andrews, Michael Robinson, Mathew Sallee, and James Wolf helped gather hydrological data in the field. We are sincerely grateful for all of the assistance we have received.

C. Funding

This Plan is funded by a grant from the California Department of Water Resources to the Ojai Valley Land Conservancy, who retained Condor Environmental Planning Services for this project. The Department awarded this grant in order to restore wetlands on the Ojai Meadows Preserve, and to find a solution to the flooding that has plagued Highway 33 between El Roblar Road and Nordhoff High School during severe winter storms for many years.

D. Contents of the Plan

This Habitat Restoration and Flood Control Plan is guided by the Ojai Valley Land Conservancy's vision and commitment to stewardship and restoration of Ojai's environment.

The plan begins by providing detailed information on the geology, climate, hydrology, ecology and history of the site that will continue to help the Ojai Valley Land Conservancy manage the property in the future. The plan includes a Geographic Information System created by Condor that provides a boundary survey and a topographic survey with contours at one-foot intervals prepared for this report, maps and other information on vegetation, species composition and distribution, wildlife habitat, hydrology, and other information that will serve as reference data for ongoing management.

A single, synthesized and detailed plan is presented that provides both flood control benefits and habitat restoration, including a preliminary grading plan, planting plan,

species list, horticultural methods and irrigation details. The Plan concludes with a maintenance and monitoring program, and a list of agency permits that are required. Finally, we are hopeful that the Plan will be used to implement a community project that generates much citizen participation and pride; and we hope that it will serve as a framework for developing educational materials and tools to serve a wide variety of audiences in the Ojai Valley.

E. Goals

The primary goals of the Ojai Meadows Restoration and Flood Control Plan are:

- Create wetlands, oak woodland, oak savanna and native grassland that are healthy and self-sustaining.
- Reduce flooding on Highway 33 and adjacent properties.
- Evaluate the potential for water re-use by Nordhoff High School.
- Promote the physical and biological functions of naturally occurring habitats in the Ojai Valley.
- Facilitate regeneration of native plants and reoccupation by native animals.
- Maximize wildlife and plant diversity and conserve local genotypes.
- Reduce the coverage and impact of invasive weeds.
- Provide pedestrian trails that accommodate existing patterns of movement.
- Facilitate learning about natural systems and appreciation of the Preserve by all visitors.
- Protect the opportunity for solitude, introspection, appreciation and wonder.

II. Methods

A. Botanical Survey and Restoration Planning

Photo 1: Botanist Mary Carroll examining wetland vegetation at the Preserve *photograph by Katrina Burton*

The Preserve was surveyed on foot by Mary Carroll, Condor Senior Botanist, and other Condor biologists on seven occasions for plant species between the awarding of the contract in September 2003 and March 3, 2004. Species were documented in field notes, and when pertinent, photographed and marked with GPS waypoints. If necessary, samples were taken and identified using a microscope and technical manuals, in particular Hickman (1993). Data recorded include species occurrence and distribution on the property, general observations of abundance, vegetation patterns, and other salient details. Particular attention was paid to the potential for regionally rare plants, such as Water-plantain (*Alisma plantago-aquatica*). The California Natural Diversity Database was consulted for documentation of rare species known from nearby areas. Preparation for the survey included a records search, review of historical aerial photographs, and discussions with other botanists with knowledge of the area, including Wayne Ferren and David Magney. Plant species nomenclature follows Hickman (1993).

Coast Live Oak (*Quercus agrifolia)* and Valley Oak (*Q. lobata*) trees were censused, and overall height and diameter at breast height determined. Larger specimens were photographed and notes made on general health. All individuals or clumps of individuals were marked with GPS waypoints and mapped. Invasive weeds were documented in notes, and where confined to a discrete area, compared with widespread occurrence, marked with GPS waypoints and mapped.

In order to discern patterns of water movement and vegetation distribution, nearby areas in the Ojai Valley were also visited. Watersheds such as the unnamed northern tributary (Map 7) and McDonald Canyon were investigated, along with nearby wetlands such as Mirror Lake and the Santa Ana wetland.

Decisions on particular plants and combinations of species to use in the restoration were derived from the Preserve itself as well as leading resources cited elsewhere in this report and the combined personal experience of our horticulturalists and botanists. Years of observation of wild habitats and efforts to grow these plants in nursery situations as well as landscape settings have informed our choices. Numbers of plants stipulated to be grown for the restoration of the Preserve were derived both using a mathematical model based on an ideal canopy size per tree as well as methods for visualizing the design concept. Nearby intact donor sites for the

proposed restoration, such as the Santa Ana wetland, were also used to cross check our estimation of individual plants needed.

B. Wildlife Survey

The Preserve was visited briefly by Vince Semonsen, Condor Senior Wildlife Biologist, on November 13, 2003. The November 13th survey was conducted on foot in the late morning using 10 x 40 binoculars to look for and identify wildlife within and around the 58-acre property. The weather conditions were mild with a temperature of 72 degrees, partly cloudy skies with a slight breeze. Birds were identified by sight and sound, along with other indicators including feathers, whitewash, pellets and nest material. Reptiles and amphibians were identified using binoculars and by overturning boards and logs. Mammals were identified by sight and sign, numerous mammal tracks were observed on the property, especially along the drainage channels. A full wildlife survey is beyond the scope of this report. The California Department of Fish and Game Natural Diversity Database was consulted for the presence of sensitive species. A list of bird species observed on the site by a local birding group was provided by John Dieges.

C. Topographic Survey

Dr. Hugo Loaiciga, Registered Civil Engineer and Senior Hydrologist, assisted by Katrina Burton, conducted a detailed topographic survey of the Preserve during the last two weeks of October 2003. They established a rectangular lattice with inter-station separation of 25 meters, using a theodolite, transit and level, stadia, wooden stakes and measuring tape. Contour lines with vertical intervals of 25 cm (approximately 1 foot) were established. The survey included the relatively level areas of the meadow as well as Happy Valley Drain, the drainage ditch and the storm collector from Nordhoff High School. A complete assemblage of all the topographic data into a site-wide map was made.

Photo 2: Dr. Hugo Loaiciga conducting the topographic survey *photograph by Katrina Burton*

D. Soil Infiltration Tests

The soil infiltration capacities were measured by Dr. Loaiciga in the field between November 7 and November 10 by means of double ring infiltrometer. The water holding capacities were determined at that time, based on the textural properties of the soils.

Photo 3: Dr. Loaiciga conducting soil infiltration test *photograph by Janet Hanstad*

E. Hydrology

Six cross-sectional surveys of the Happy Valley Drain and eight cross-sectional surveys of the Nordhoff Drain, as well as a longitudinal survey were conducted in the field. These are provided on the topographic map prepared for this plan. Roughness coefficients were determined in the field. A team consisting of Dr. Loaiciga, Katrina Burton, and two other field assistants carried out the hydraulic data collection. These data were used to build a hydraulic model for Happy Valley Drain, Nordhoff Drain, and adjacent floodplain.

The conveyance capacity of the Happy Valley Drain and drainage ditch was determined based on the topographic survey and Manning's equation. The hydraulic functions of these two channels were assessed based on the estimated runoff that enters into the Preserve and that is produced within the Preserve by 24-hour rainfall of various intervals (5, 10, 25, 50, 100 and 500 years).

The Soil Conservation Service TR-55 and the Hydrologic Engineering Center rainfall-runoff models were implemented to simulate the rainfall-runoff dynamics in the Preserve for 24-hour rainfall of various intervals (5, 10, 25, 50, and 100 years). The water-storage capacity in the Preserve was determined based on the results of the above tasks, the movement of runoff throughout the Preserve, and the areas of runoff accumulation.

The subsurface and surface hydrologic characteristics of the Preserve was integrated to develop a comprehensive descriptive model of runoff and shallow subsurface movement, surface and subsurface water-storage, and hydrograph characteristics in and out of the main drainage features.

Evapotranspiration from moist and water-covered areas was calculated using temperature-based formulas (Hargreaves, Thornthwaite, Blaney and Criddle). These

calculations were used to establish the water balance of wetland areas in the OMP and to understand the existing and potential duration of ponding in the existing and enhanced system of wetlands.

F. Property Boundary Survey

The boundaries of the property were measured based upon the locations of fencing in the field using a theodolite, level and stadia. It should be noted that because official surveyed documents were not available, assumptions about the locations of property boundaries had to be made in the field. This resulted in several discrepancies that could be corrected with the use of data from the County Recorder's office. The magnitude of the discrepancy is 4.33 acres; namely, the boundary survey for this report, as shown in Table 1, is 4.33 acres greater than the probable boundary provided by the Ventura County Geographic Information System. The boundaries of the property shown on the maps in this report represent Ventura County parcel data.

G. Mapping and GIS

The Geographic Information System (GIS) and maps produced for this report were developed using ArcView 8.3 software. Data sources include parcel boundary data and hydrologic data provided by the Ventura County Watershed Protection District, an aerial photograph provided by Air Photo USA, dated September 2002 and historical aerial photographs obtained from University of California at Santa Barbara Map and Imagery Lab. All other data were developed by Condor, as described above.

H. Water Quality Sampling

Water quality sampling was conducted by Condor in February and March 2004. Samples were collected from the four water input areas of the Preserve:

(1) Nordhoff High School at the inlet pipe
(2) Taormina housing community at the inlet pipe
(3) Happy Valley Drain as it enters the preserve
(4) Nordhoff Drain at Highway 33.

The samples were analyzed by Capco Analytical Services, Inc. a licensed, professional testing laboratory in Ventura, to determine the presence of the following contaminants:

- Minerals (including nitrogen and others);
- Oil and grease;
- Residual chlorine;
- Organochlorine pesticides;
- "Roundup" herbicide;

- Phosphate, and
- Fecal coliform.

Standard protocol for most water quality testing is to test once per quarter and at or after significant runoff events. In order to obtain statistically significant (valid) results on fecal coliform bacteria, testing is needed approximately once per week for five consecutive weeks. Samples were collected once each week for five consecutive weeks in February and March 2004.

Photo 4: Katrina Burton collecting water quality samples *photograph by Elihu Gevirtz*

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III. Environmental Setting

The Ojai Meadows Preserve is nestled in a valley remarkable for many biological and geological features. Situated in a geological transition zone, this region is influenced by the confluence of the Transverse Ranges of southern California and the Sierra Madre Mountains of central California.

A. Topography

The Preserve lies in the western portion of the Ojai Valley, a 12-mile long and 3-mile wide east-west aligned syncline located between the Sierra Madre Mountains and the mountains of the coast range of California (Map 3). North of the Preserve is Nordhoff Ridge, which includes Nordhoff Peak at 4,485 feet in elevation. Further north is Pine Mountain at 7,510 feet. The Topa Topa range, a series of steep and rugged mountains, dominates the horizon to the northeast reaching over 6,700 feet. The Santa Ynez Mountains (4,707 feet at Divide Peak) reach their easterly terminus northwest of the Preserve, west of Matilija Canyon. Krotona Hill rises immediately south of the Preserve, and is a small blind thrust scarp reaching 880 feet elevation. Sulphur Mountain (2,727 feet), Black Mountain (1,797 feet) and Red Mountain (2,163 feet) are located south of Ojai. Santa Paula Ridge is situated to the east at 4,957 feet. The Ventura River is located less than a mile (0.79 miles) west of the Preserve.

The Preserve itself is located at approximately 730 feet elevation at the southwest end of the Ojai Valley. The topography of the Preserve is relatively flat, ranging from 728 to 743 feet in elevation (Map 4). It has an area of 57.17 acres within an odd-shaped polygon whose metes and bounds are reported in Table 1 and plotted on Map 5. The reader should note that a legal description of the property was not available to the investigators, and therefore, the boundary survey was completed in the field based upon existing fencing and other physical features including perimeter roads. This has resulted in a discrepancy of 4.33 acres between the County parcel data and the survey data presented in Table 1 and Map 5. The total acreage of the project site used throughout this Plan is 57.17 acres, consistent with County parcel data.

Photo 5: View of Topa Topa Range from Ojai Meadows Preserve *photograph by Mary Carroll*

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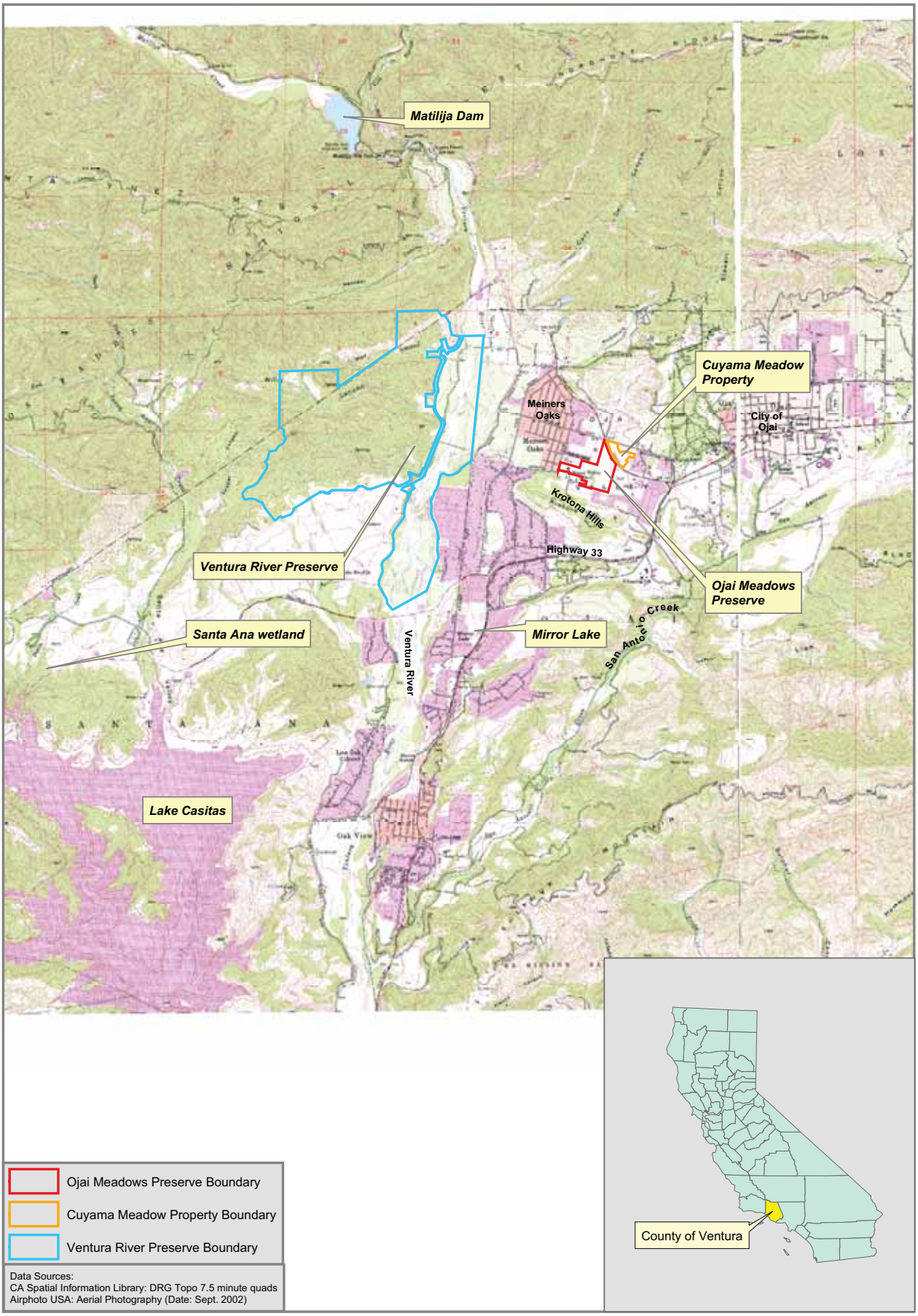

Regional Topography

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0 2,800 5,600 8,400 11,200 Feet

Ojai Meadows Preserve
Ojai Valley Land Conservancy

Map 3
May 2004

Data Sources:
Condor Environmental: Topographic Survey (Date:2003)
Ventura County: Hydrology
Ojai Valley Sanitary District: Sewer information
Airphoto USA: Aerial Photography (Date: Sept 2002)

Existing Site Features

Condor Environmental Planning Services, Inc.

0 295 590 1,180 Feet

Ojai Meadows Preserve
Ojai Valley Land Conservancy

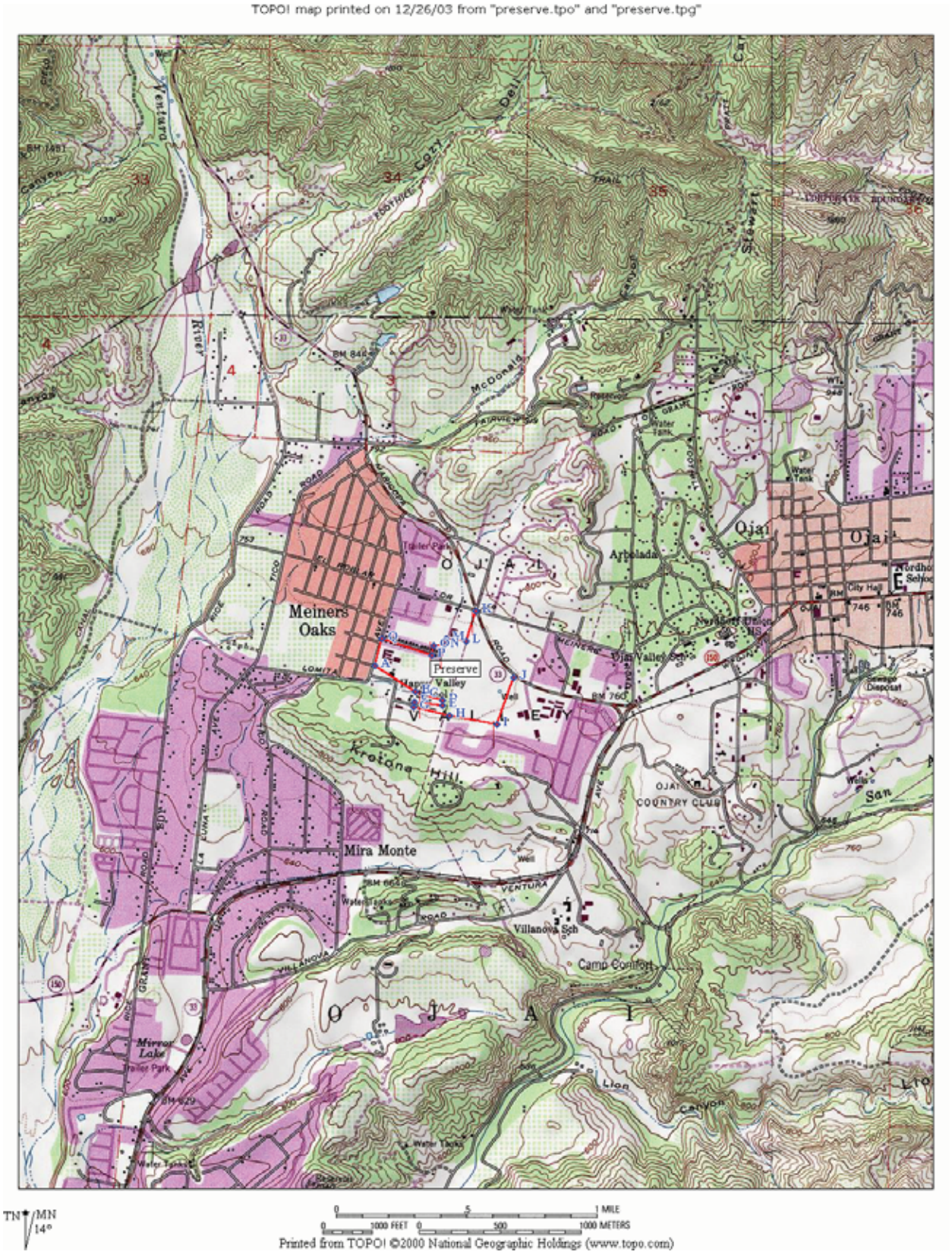
Map: 4
May 2004

Table 1
Metes and bounds of the Preserve*

		UTM-NAD83 Zone 11 North			
Corner	**Line or arc**	**Easting (meters)**	**Northing (meters)**	**Length (meters)**	**Bearing (degrees)**
A		290712.09	3813680.13		
	arc AB[1]			242.93	S 68.03 E
B		290934.49	3813590.43		
	BC			27.22	S 30.41 E
C		290948.27	3813566.95		
	CD			189.43	S 69.84 E
D		291126.09	3813501.66		
	DE			45.46	S 16.67 W
E		291113.05	3813458.11		
	EF			182.34	N 74.74 W
F		290937.14	3813506.09		
	FG			27.28	S 16.65 W
G		290929.32	3813479.95		
	GH			276.47	S 74.05 E
H		291195.15	3813403.99		
	HI			226.64	S 76.06 E
I		291415.11	3813349.39		
	IJ			409.43	N 17.83 E
J		291540.47	3813739.16		
	arc JK[2]			371.22	N 25.59 W
K[3]		291382.00	3814070.00		
	KL			267.97	S 16.67 W
L		291305.13	3813813.29		
	LM			135.41	N 67.97 W
M		291179.61	3813864.09		
	MN			81.72	S 16.67 W
N		291156.17	3813785.80		
	NO			107.98	N 76.25 W
O		291051.28	3813811.46		
	OP			109.01	S 16.67 W
P		291020.00	3813707.03		
	PQ			287.25	N 73.45 W
Q		290744.65	3813788.86		
	QA			113.50	S 16.67 W
A		290712.09	3813680.13		
			perimeter =	3101.28	
	[1]center point	290829.58	3813650.84		
	[2]center point	291439.01	3813893.98		

* This table is based on a survey for this plan by Hugo Loaiciga, Licensed Civil Engineer. See Map 4. The reader should note that a legal description of the property was not available to the investigators, and therefore, the boundary survey was completed in the field based upon existing fencing and other physical features including perimeter roads. This has resulted in a slight discrepancy between the County parcel data and the survey data presented above.

[3] This point was estimated and is located at the intersection of El Roblar Drive and Highway 33.



Map 5: Metes and Bounds location map of the Ojai Meadows Preserve, whose approximate perimeter coincides with the red lines near the center of the map.

There are several steep south-facing canyons that descend from Nordhoff Ridge into the Ojai area. Cozy Dell Canyon, to the northwest of the Preserve, drains directly into the Ventura River. Stewart Canyon, located immediately north of Ojai, is one of the primary drainages of Nordhoff Peak. It is channelized as it traverses the city of Ojai and a debris basin has been constructed at its mouth by the U.S. Army Corps of Engineers. It eventually drains into San Antonio Creek, a major tributary of the Ventura River. Other canyons such as Gridley and Senior Canyons, also originate on Nordhoff Ridge and drain south into Ojai. Most drainages in the City of Ojai have been channelized, including the Happy Valley Drain that traverses the Ojai Meadows Preserve.

Photo 6: View of Nordhoff Ridge from Ojai Meadows Preserve *photograph by Mary Carroll*

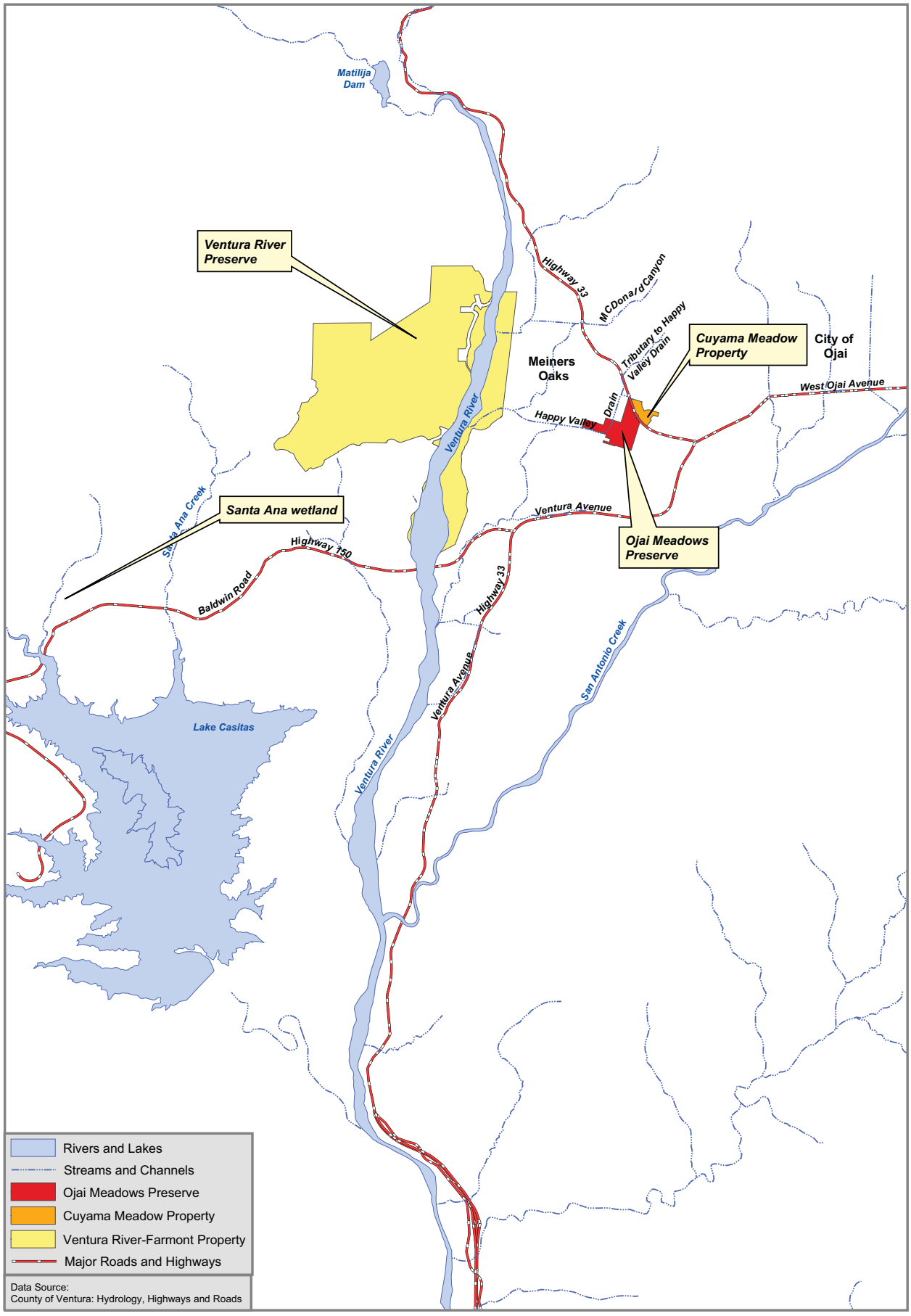
Before debris basins and dams were constructed in and around Ojai, large alluvial fans formed at the base of these northern canyons along the northern Ojai Valley. Evidence of this is observed in the sediment deposition that can be found today by examining the topography, core data from wells and soil maps (U.S. Soil Conservation Service 1986, California Geological Society Seismic Hazard Zone Report 072 2002).

B. Geology and Soils

The Ojai Meadows Preserve itself is located primarily on ancient stream terrace deposits from the Ventura River of Pleistocene and Holocene age (1.6 million years ago to present). In addition, the north end of the Preserve contains a finger of alluvial deposits originating from Nordhoff Ridge, which lies on top of the old stream terrace deposits (Magney 2001). Some of these deposits are 700 feet deep in the Ojai Valley (State of the Watershed – Ventura River 2002). A fault line is present at the base of Krotona Hill on its' south side. This may contribute to patterns of flooding on the Preserve. Evidence supporting subsurface flow is provided in a soil boring test conducted by David Magney Environmental Consulting (2001). Fine Sandy Loam soil was found to be saturated 22 inches below the surface.

The predominant soils on the site (Map 6) are the Ojai very fine sandy loam series (OhC2), consisting of fine sandy loams that have a sandy clay loam subsoil. In general, these loams are very well drained. These soils are on the eastern ("Palmer property") portion of the site. Soils on the western portion of the Preserve ("Besant Meadows" and western "Palmer property") have higher silt and/or clay content,

which is characteristic of the Sorrento clay loam series (SzC). Ojai stony fine sandy loam (OsD2) is found near the southern end of the Eucalyptus grove and on the far western end of the 'panhandle' (Edwards et al. 1970, Magney 2001).



Regional Hydrology

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0 2,800 5,600 8,400 11,200 Feet

N

Ojai Meadows Preserve
Ojai Valley Land Conservancy

Map 7
May 2004

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C. Climate

The local weather pattern is mild, wet winters and hot, dry summers. The mean annual temperature in Ojai is 61.7°F, with a mean January low of 45.8°F and a mean July high of 77.7 °F. Temperatures drop below freezing on winter nights about 25 nights a year. The lowest temperature ever recorded was 16 °F in December 1990, and the highest temperature ever recorded was 112 °F in September 1955 (California Annual Temperature Summary 1948-2000).

Average annual precipitation in the Ojai area is 21.8 inches (National Weather Service nwsla.noaa), falling primarily between October and April. The maximum recorded annual rainfall for Ojai was 47.3 inches of precipitation in 1978, more than twice the mean. In 1995 7.1 inches fell in one day in the Ojai area. The largest 'peak discharge' recorded in San Antonio Creek in Ojai was 16,200 cf/sec on January 25, 1969. In contrast, the lowest annual precipitation recorded in Ojai was 7.32 inches in 1972. (Ventura County Flood Hazard Safety Element 1991, California Annual Precipitation Summary 1948-2000).

D. Flooding

The Ojai area is subject to flooding every few years (Ventura County Flood Hazard Safety Element, 1991). Historic floods in the Ojai area have occurred in 1862, 1867, 1884, 1911, 1914, 1938, 1943, 1952, 1958, 1965, 1966, 1969, 1978, 1983, 1992-3, 1995, and 1996.

Photo 7: View of Preserve looking south from St. Thomas Aquinas Catholic Church, 1996. *photograph by Richard Handley*

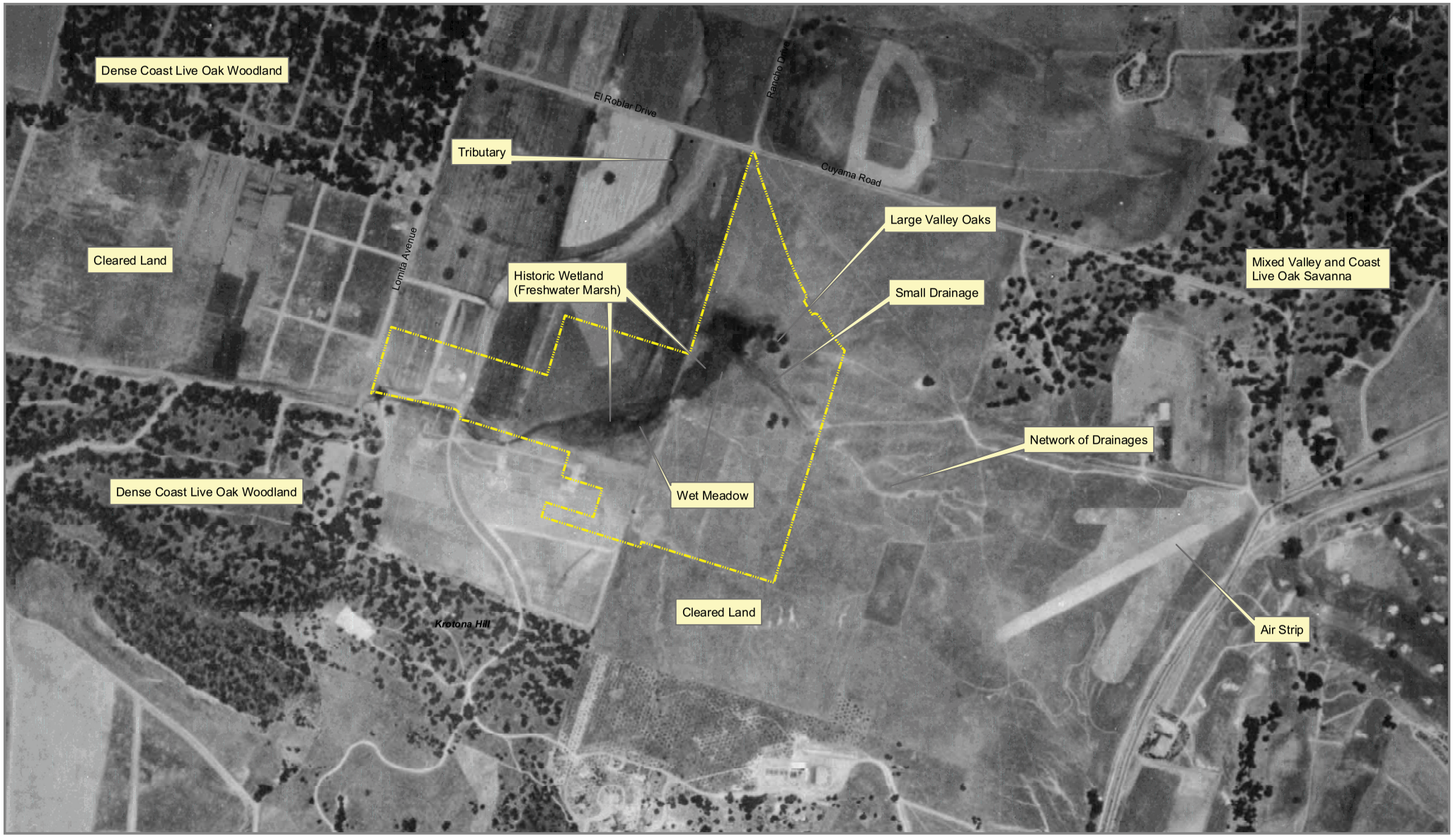
Flooding can result from a combination of intense winter storms originating in the Pacific coupled with rugged mountains that rise several thousand feet in elevation. As moist air is forced upward over mountain ranges, the air cools and precipitation quantities increase. Large storms lasting one to several days can produce torrential runoff once the soil is saturated. Water rushes down slopes into canyons that drop sharply from the mountains to the valley below. Water and debris literally come barreling out of mountain canyons, and potential flooding is exacerbated by impermeable surfaces of urbanized areas as well as any recent wildfires that may have denuded slopes upstream.

Photo 8: View of confluence of Happy Valley and Nordhoff Drains, 1998 *photograph by Richard Handley*

While a heavy storm in Ojai can drop 5 or more inches of precipitation, precipitation rates can increase by 5 inches for every 1,000 feet in elevation gain. Hence, a 7 inch storm in Ojai can be producing 20 inches of rain on Nordhoff Ridge. According to news accounts, two storms "dropped up to 30 inches of precipitation over a period of four days" in the Ojai area in 1969 (Ojai Valley News, April 12, 2002). This can lead to massive debris slides. For example, over 200,000 cubic yards of debris were deposited in the Stewart Canyon Debris Basin during the storms of January and February 1969. According to local news accounts, the 1969 'big flood' cost one life, destroyed homes, and washed away two holes at a local golf course (Ojai Valley News, April 12, 2002). Several other lives were lost just north of Ojai on Sespe Creek during that same storm (Keep the Sespe Wild, 2004).

E. Existing Hydrology

The Preserve is a low-lying area where runoff converges on its way to the Ventura River, the largest link in the regional drainage basin, located a few kilometers to the west, and shown in Map 7. Two man-made ditches drain the Preserve, which receive water inputs from surrounding higher elevation lands (as described above), from rainfall, and from storm pipes. The two man-made ditches are the Happy Valley Drain and the Nordhoff Drain, both shown in Map 4. A third ditch is located south of the Saint Thomas Aquinas Church buildings, outside of the Ojai Meadows Preserve. In addition to rainfall and runoff, as we have already stated, subsurface flow of water is suggested by the presence of Fine Sandy Loam soil saturated by water 22 inches below the surface during a soil boring test conducted by David Magney Environmental Consulting (2001).



1929 Aerial Photograph

Ojai Meadows Preserve Boundary

Data Sources:
UCSB Map and Imagery Lab: May 9, 1929 Aerial Photo (Fairchild Aerial Survey (C-509))

Condor Environmental Planning Services, Inc.
Tel: (805) 965-9139 - www.condorenvironmental.com

0 500 1,000 2,000 Feet

Ojai Meadows Preserve
Ojai Valley Land Conservancy

Map: 8
May 2004

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Photo 9: Happy Valley Drain on the Preserve *photographs by Mary Carroll and Katrina Burton*

Happy Valley Drain is part of the Ventura County flood-control infrastructure serving the town of Meiners Oaks. The drain is concrete lined upstream and downstream of the Preserve but is unlined within the Preserve. Its banks and channel bottom on the Preserve have been eroded, particularly near its exit from the Preserve and are in need of maintenance. Storm flow in the Happy Valley drain is swift and perilous to cross during heavy rain. The accumulation of mud in the bottom of Happy Valley Drain and its steep slopes is a nuisance to trail users and hinders pedestrian and bicycle travel during and after heavy rains.

Photo 10: Eroded Banks of Nordhoff Drain *photograph by Mary Carroll*

The Nordhoff Drain is a degraded water-conveyance feature that dissects the Preserve from the northeast to the southwest along a low-elevation axis toward Happy Valley Drain. The Nordhoff Drain is a poorly maintained channel. Its banks have been deeply eroded and its bottom is gullied at several locations. This drain is used as a dwelling site by homeless persons, who dispose visible amounts of trash in it. This drain also hinders pedestrian and bicycle travel during and after heavy rain.

Two storm pipes discharge at point H on the southern perimeter of the Preserve. These pipes drain a portion of Krotona Hill and the Taormina neighborhood, which overlook the Preserve from the south (Map 4). Their discharges have carved a small gully on the sandy-loamy soils found south of the Nordhoff drain. Storm runoff from the Krotona Hill pipes flows through the gully toward the Nordhoff Drain and eventually spreads out as overland flow towards the Nordhoff drain. Most of this overland flow infiltrates the soil and is eventually evapotranspired, without ever becoming channelized flow.

Photo 11: Storm pipes from Taormina neighborhood *photograph by Katrina Burton*

A third storm pipe is located on the eastern boundary of the Preserve that is shared with Nordhoff High School (line IJ in Map 4), approximately 140 meters from node I. This pipe collects runoff from the high-school grounds and facilities and conveys it to the Preserve, where it is disposed as a point discharge. Rainfall and irrigation surplus water comprise the primary sources of the discharge. Chlorine may have been present in some of the water coming off of the high school in fall 2004, but this appears to have been an isolated incident. The discharge has created a small pool at the pipe's terminus which is conspicuously unpleasant to the eye. Algal growth – apparently enhanced by nutrients in the pipe's water - is ubiquitous in the pond during the warm months. Some of the pipe's discharge flows overland towards the Nordhoff drain, and the remainder infiltrates the soils in that portion of the Preserve and is ultimately evapotranspired.

1. Flood Analysis

a) Immediate Watershed.

Approximately 221 acres (2.621×10^6 m^2) of land drain toward the 57.17 acre Preserve, in addition to rain that falls directly upon it. The external runoff from the north, northeast and northwest is captured by the Happy Valley Drain and flows through the Preserve. On the eastern side of the Preserve, Highway 33 receives runoff from the Cuyama Meadow property and adjacent properties to the east and Nordhoff High School to the south.

Based on estimates from the School District, all of the runoff generated by the High School is piped and disposed as a point discharge within the Preserve, as discussed above. It estimated that the total storm water drainage to the Preserve from the High School is 100 cfs. Runoff from parcels on Krotona Hill are also discharged into the Preserve. All other runoff reaches the Preserve as overland or subsurface flow.

b) The Happy Valley and Nordhoff Drains

Figures 1a and 1b show the existing longitudinal profiles along the center axis of the channel ("thalweg") of each drain. It is deduced from these Figures that the Nordhoff drain has a drop of 5.68 feet (1.73 meters) between Highway 33 and the confluence with the Happy Valley drain. This drop occurs over a length of 1,570 feet (478 meters), implying a channel slope of 0.362 %. This is a very mild slope.

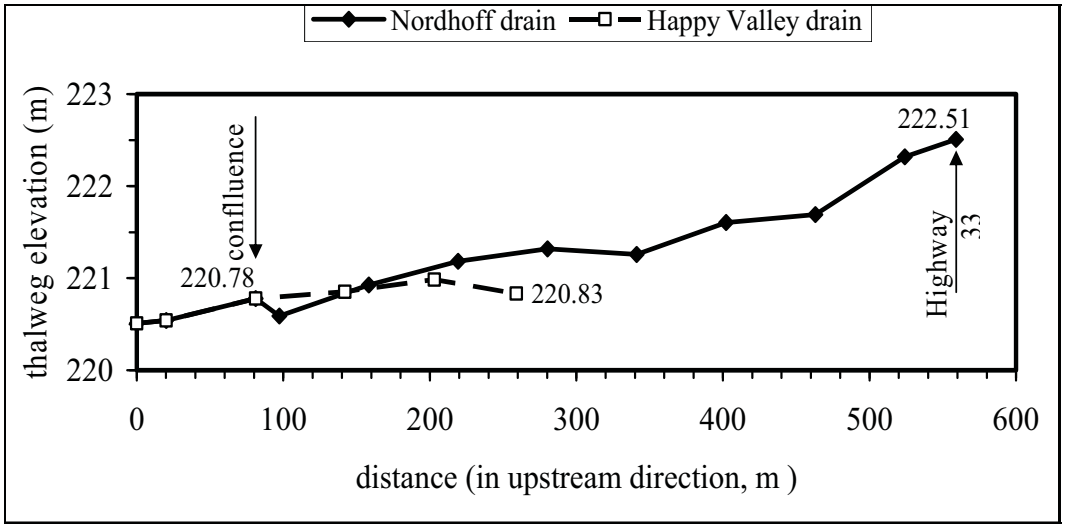


Figure 1a. Longitudinal profiles of the Happy Valley and Nordhoff drains (in meters).

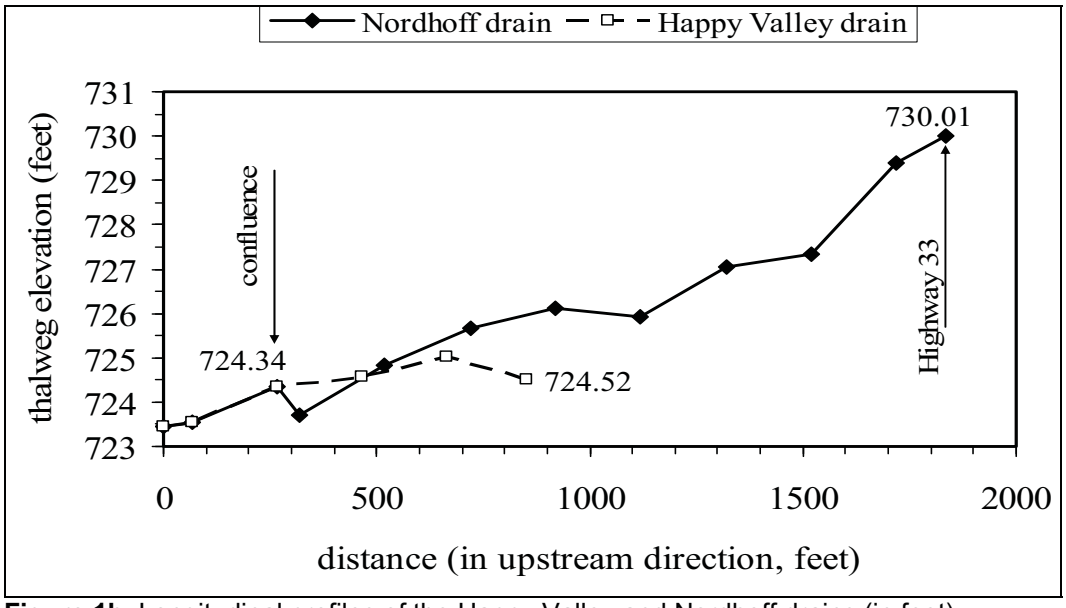


Figure 1b. Longitudinal profiles of the Happy Valley and Nordhoff drains (in feet).

The difference between the magnitudes of the hydraulic energy[1] at the point of confluence of the two drains and that at the headwaters of the Nordhoff drain is what determines the (energy) slope that drives flow in the Nordhoff drain. This is based on the Manning equation for channel flow, which stipulates that channel flow is proportional to the square root of the energy slope (see, for example, Chow, 1959). The energy slope is less than the 3.62/1000 slope determined from topographic relief.

Evidently, the conveyance capacity of the Nordhoff drain depends on its own hydraulic characteristics and those of the Happy Valley drain. Deepening or widening of the Nordhoff drain can increase its conveyance capacity only if there is concomitant deepening or widening of the Happy Valley drain along its unlined reach which is within the Preserve. The elevations of the Happy Valley drain at its entrance to and exit from the Preserve, however, are fixed by the elevations of existing concrete lined segments of the drain at these locations, which constrain the extent of deepening that can be exerted in this drain without resorting to major changes along its entire length.

Figure 2 shows average cross sections of the Happy Valley and Nordhoff drains. These cross sections are perpendicular to the average velocity of stream flow in the channels. Their areas represent the wetted areas at bankfull discharge. The cross sections in Figure 2 represent averages of several cross sections surveyed along the length of each drain. The cross sections vary from location to location, particularly along the Nordhoff drain. The banks of the cross sections in Figure 2 have a slope of 1:1, that is, one foot of vertical rise for each foot of horizontal displacement. This is an approximation to field conditions because bank slopes have been eroded and do not conform exactly to the trapezoidal shape used in our analysis. The bankfull discharges in the Happy and Nordhoff drains were estimated to be 182 and 1066 ft^3 s^{-1} (cubic feet per second, where 1 ft^3 s^{-1} = 0.02832 m^3 s^{-1}) respectively, using the Manning equation.

[1] The hydraulic energy is the sum of the water-surface elevation and the kinetic energy (per unit weight) of moving water in a channel. It has units of length (meters or feet, for example).

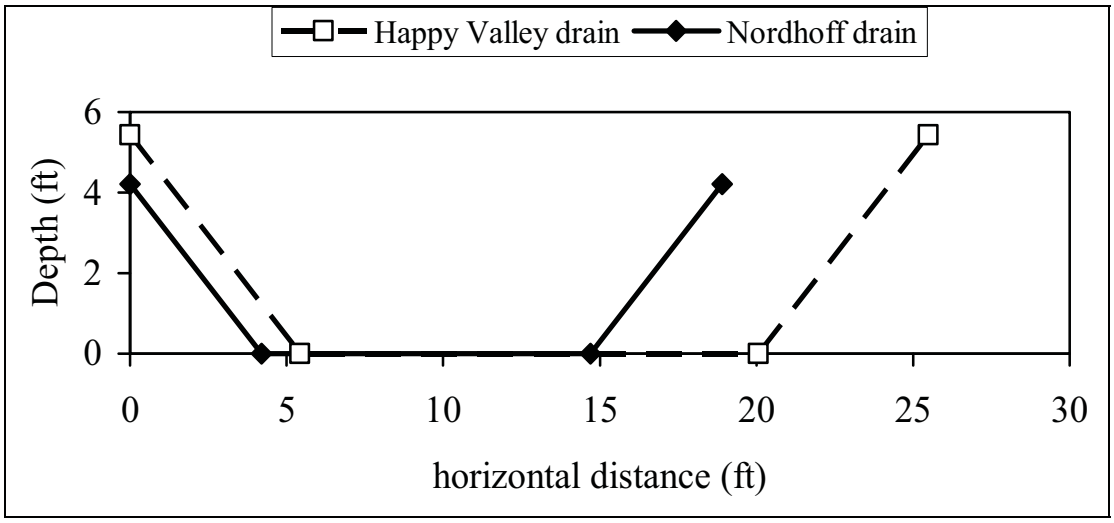


Figure 2. Approximate average cross sections of the Happy Valley and Nordhoff drains in existing conditions. (1 ft = 0.3048 m; 1 $ft^3 s^{-1}$ = 0.02832 $m^3 s^{-1}$).

The bankfull discharge in the Nordhoff drain was estimated using a slope of 3.62/1000, a depth of the trapezoidal cross section equal to 4.21 ft, and a roughness coefficient n = 0.06 (Figure 3). The slope and cross-sectional geometry are only approximate. The roughness coefficient was assigned by Dr. Loaiciga based on an inspection of current hydraulic conditions in the Nordhoff drain.

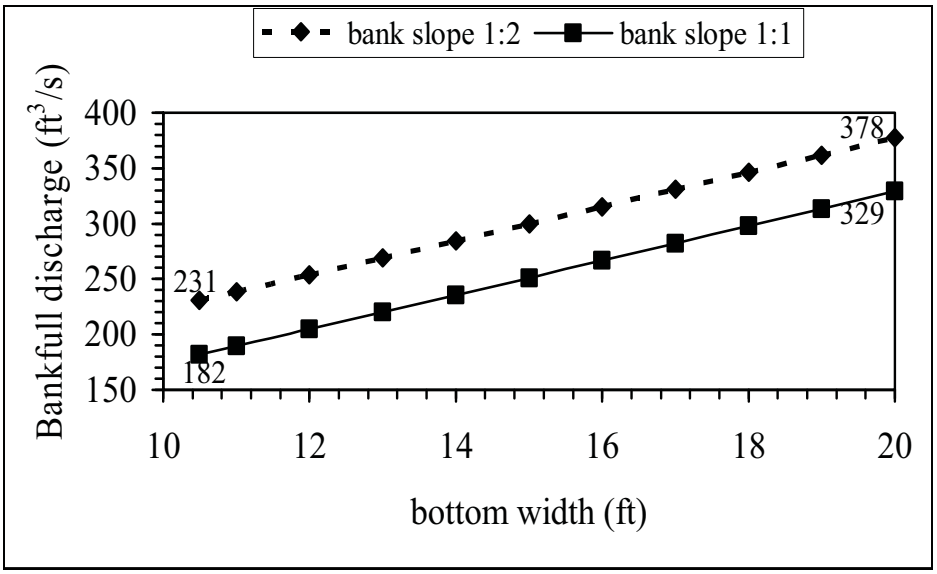


Figure 3. Bankfull discharge in the Nordhoff drain assuming a trapezoidal cross section with depth = 4.21 ft, slope equal to 0.00362, and roughness coefficient n = 0.06. Bank slope 1:x means one foot of vertical rise for x feet of horizontal displacement. (1 ft = 0.3048 m; 1 $ft^3 s^{-1}$ = 0.02832 $m^3 s^{-1}$).

Although decreasing the hydraulic roughness characteristics of the Happy Valley and Nordhoff drains (by removing vegetation) would decrease flooding on the Preserve when combined with widening of their cross-sectional areas, this would

not achieve the ecological restoration objectives of the Restoration Plan. Therefore (as discussed later in the text) we recommend widening of both drains in order to increase their conveyance capacity, while, at the same time, modifying ground elevations in certain areas of the Preserve to improve the ponding of runoff in those areas.

c) Rainfall-runoff relationships.

The U.S. Soil Conservation Service (U.S. SCS) TR-55 rainfall-runoff model (U.S. SCS, 1986) was utilized to calculate runoff hydrographs at the outlet of the Happy Valley drain from the Preserve. The TR-55 model was driven by 24-hr storms with return periods of 2, 25, and 100 years. In addition, the 24-hr probable maximum precipitation (PMP)[2] was input to drive the TR-55 model. The 2-, 25-, and 100-yr total rainfall depths were obtained from Miller et al. (1973). The PMP rainfall depth was obtained from U.S. Weather Bureau (1960). The temporal distribution of rainfall over the 24-hr duration for the 2-, 25-, and 100-yr events and the PMP was the SCS Type I distribution, applicable in the study region (U.S. SCS, 1986). The TR-55 calculated the runoff generated from all the tributary lands outlined in Figure 4 and from the Preserve itself. The curve numbers used in the TR-55 models were the same as those in Dunbar et al. (2001).

Figure 4 shows the TR-55-generated hydrographs. The Figure also includes the bankfull discharges for the Happy Valley and Nordhoff drains (1,066 and 182 $ft^3\ s^{-1}$, respectively). Comparing peak flows to channel capacity, the peak flows associated with the 2-, 25-, 100-year storms and the PMP rainfall events are 589, 1,636, 2,080, and 6,776 $ft^3\ s^{-1}$, respectively. The 25- and 100-year storms and PMP rainfall events produce peak flows that exceed the bankfull discharge of the Happy Valley drain. These peak flows overflow into the Happy Valley drain's left and right overbanks, causing flooding.

[2] The PMP is the physical upper limit of the amount of precipitation that can fall over a specific region in a given time. The given time equals 24 hours in this case.

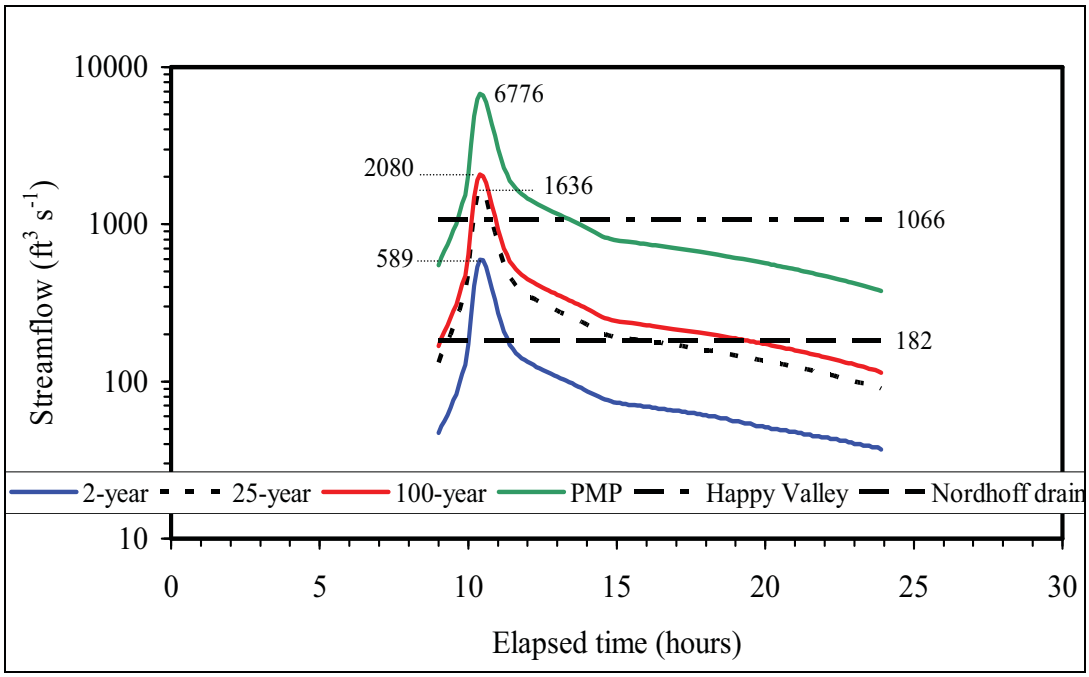


Figure 4. Hydrographs at the outlet of Happy Valley drain from the Preserve. The hydrographs were calculated with the TR-55 model for 2-, 25-, 100-yr and the PMP 24-hr rainfall events, using rainfall distribution type I applicable in the study area. The peak flows associated with each rainfall events are written in each hydrograph. The bankfull discharges for the Happy Valley and Nordhoff drains are depicted by horizontal lines (labeled 1066 and 182 $ft^3\ s^{-1}$, respectively). (1 $ft^3\ s^{-1}$ = 0.02832 $m^3\ s^{-1}$).

The calculations presented above and below (see Figure 5) demonstrate that by enlarging the Happy Valley drain's bottom width to 30 ft (and maintaining the banks' slope at 1:1) the bankfull discharge could be augmented to 2086 $ft^3\ s^{-1}$, which exceeds the 2-, 25-, and 100-yr peak flows. If the banks' slope is decreased to 1:2 and the bottom width is enlarged to 27 ft, the bankfull discharge in the Happy Valley drain would rise to 2147 $ft^3\ s^{-1}$ (see Figure 5), enough to pass the 2-, 25-, and 100-yr peaks flows. These modifications involving banks' slope equal to 1:2 are appealing in terms of flood control and the ability to enhance bank stability. The banks' slopes could be made even milder, e.g., 3:1, with the aim of enlarging the riparian zones of the Happy Valley and Nordhoff drains and facilitating human transit trough the drains when they are dry, while providing flood relief.

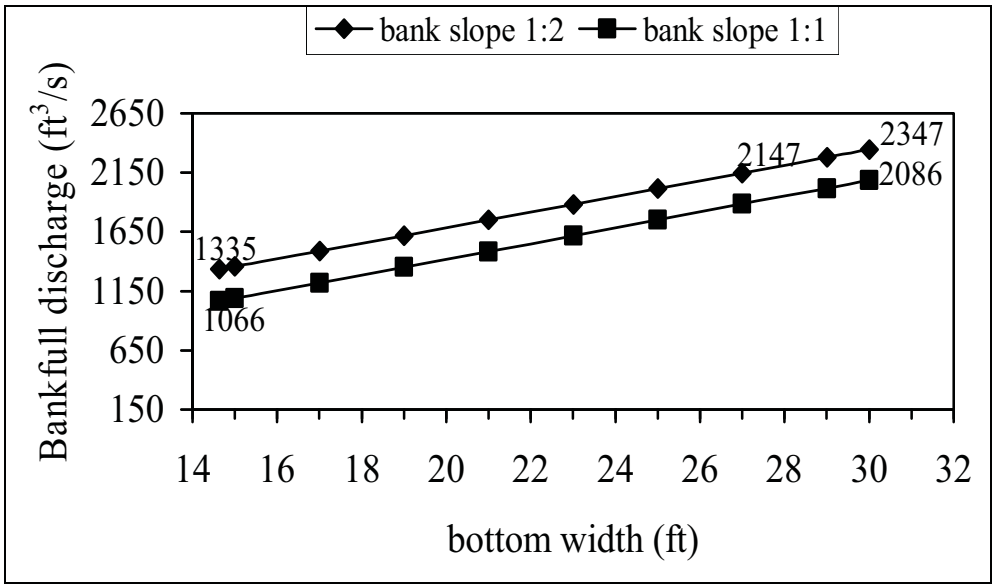


Figure 5. Bankfull discharge in the Happy Valley drain assuming a trapezoidal cross section with depth = 5.43 ft, slope equal to 0.0025, and roughness coefficient n = 0.018. Bank slope 1:x means one foot of vertical rise for x feet of horizontal displacement. (1 ft = 0.3048 m; 1 $ft^3\ s^{-1}$ = 0.02832 $m^3\ s^{-1}$).

Nordhoff drain collects runoff from the surrounding area, and from land within the Preserve lying above the confluence with the Happy Valley drain. The peak flows generated by the 2-, 25-, 100-yr, and PMP rainfall events in the Nordhoff drain at its confluence with the Happy Valley drain were calculated with the TR-55 model to equal 282, 745, 942, and 3023 $ft^3\ s^{-1}$, respectively. Recalling the calculations presented in *Flood Analysis: the Happy Valley and Nordhoff Drains* section of this report, where it was shown that the Nordhoff drain could be upgraded to a bankfull discharge of 760 $ft^3\ s^{-1}$, we conclude that the Nordhoff drain system could be improved to pass the peak flow generated by a 25-yr, 24-hr, rainfall event (because 760 > 745 $ft^3\ s^{-1}$) . This would require, however, a concomitant enlargement of the Happy Valley drain, whose bankfull capacity of 1066 $ft^3\ s^{-1}$ is less than the runoff of 1636 $ft^3\ s^{-1}$ produced in it by the 25-yr, 24 hr, storm.

Without enlargement of the Happy Valley drain, the discharge in the Nordhoff drain would be backed up and there would be flooding caused by overflow in both drains. Under current conditions, the Happy Valley-Nordhoff drain hydraulic system does not have the capacity to pass peak flows produced by 24-hour rainfall events with a return period of 25 years or longer. Such rainfall events overflow both drains and create ponds of variable duration depending on the amount of rainfall. In fact, flooding of Highway 33 on the eastern boundary of the Preserve appears unavoidable for 24-hr rainfall events with returns periods as short as 2 years, unless improvements are made to the Nordhoff drain.

d) Runoff from Nordhoff High School and the Krotona Hills.

The TR-55 rainfall-runoff model produced estimates of the runoff stemming from Nordhoff High School's grounds (approximately 40 acres). For the 2-, 25-, 100-year and PMP, 24-hr, storm events the estimated peak flows are 56, 134, 167, and 512 cubic feet per second, respectively. From a visual inspection of the High School parcel it is estimated that about one third of the runoff is captured by the school's pipe that discharges to the Preserve. Runoff estimates were also produced for parcels in the Krotona Hill area. The estimated peak flows associated with the 2-, 25-, 100-yr and PMP, 24-hr, storm events are 87, 230, 292, and 941 $ft^3 s^{-1}$, respectively. We estimate that about one third of the runoff from these parcels is captured by the pipes.

e) Further analysis concerning flood frequency.

The Happy Valley drain has a stream gauge at 633 Rice Road in Meiners Oaks[3]. The Ventura County Public Works Agency (2001) used 27 years of annual peak flow data at the stream gage to estimate the Happy Valley drain's flow-frequency function, which relates the magnitude of annual peak flow to the return period (in years) of the flow. Figure 6 shows the expected peak flow estimates (middle graph) and their 5% (upper) and 95% (lower) confidence limits[4]. We have highlighted on Figure 10 the 100-yr expected peak flow (=1,330 $ft^3 s^{-1}$), and its lower and upper confidence limits (= 848 and 2,000 $ft^3 s^{-1}$, respectively). These estimates compare with a peak flow of 2,080 $ft^3 s^{-1}$ produced by the 100-year, 24-hr, rainfall event (Figure 4).

Discrepancies among the flow-frequency peaks and the storm-based flow peaks do occur for the 2- and 25-yr events also. One must keep in mind that the tributary areas to 633 Rice Road and to the Happy Valley drain at the Preserve's outlet are unequal. This is one reason for the observed discrepancies among the annual peak flows and the rainfall-based peak-flow estimates. But such discrepancies would arise even if the tributary areas were the same. This is so because the annual peak flows and the rainfall-based peak-flow estimates represent two different hydrologic entities[5].

[3] The tributary area upstream of the stream gage is larger than that upstream of the Preserve's outlet.
[4] The 5% and 95% confidence limits have probabilities of 5% and 95%, respectively, of being exceeded.
[5] The flow-frequency function is derived from a series of peak flows at a given location in a stream, with each peak flow being the maximum in one of the years included in the period of analysis. The rainfall-based peak flows at a given stream location, on the other hand, are determined from hydrographs caused by storms of a specified duration (say, 24 hours) and return period (say, 25 years). The storm events may have none or multiple occurrences within a given year in the period of study.

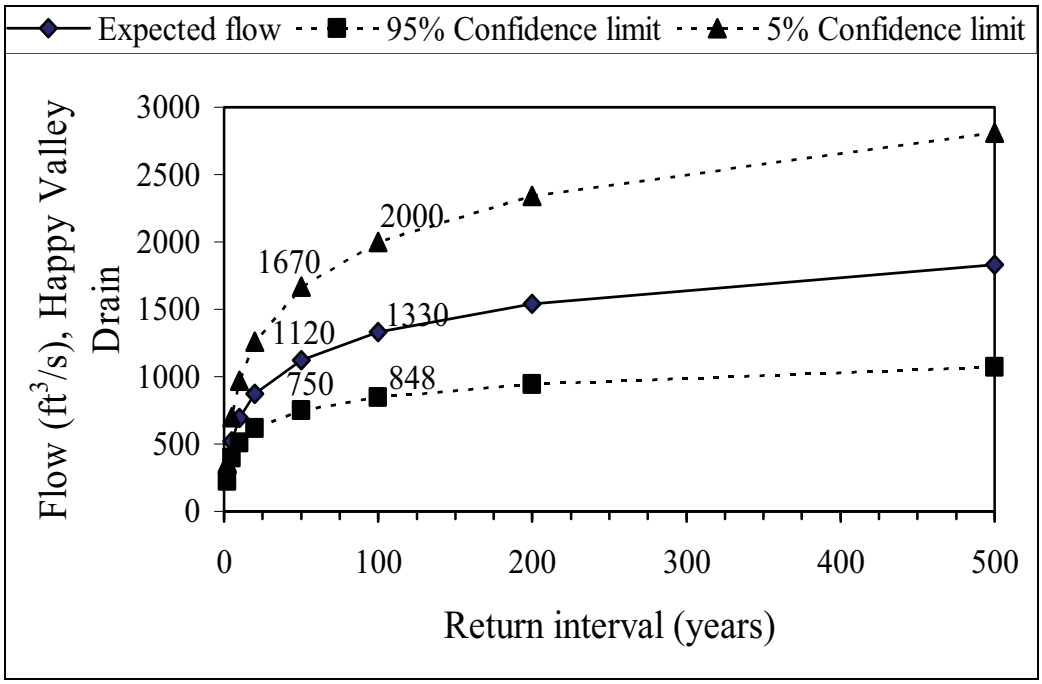


Figure 6. Flow-frequency estimates in the Happy Valley drain at 633 Rice Road, Meiners Oaks, California. (Ventura County Public Works Agency, 2001). (1 $ft^3\ s^{-1}$ = 0.02832 $m^3\ s^{-1}$).

The above calculations point out that current flood protection in the neighboring areas is limited to hydrologic events that are smaller in magnitude than 25 years6, whether classified in terms of rainfall recurrence or by annual peak flow frequency. The proposed wetland restoration and associated modifications of the Happy Valley and Nordhoff Drains may increase the level of flood protection to 24-hr storms with return periods of about 25 years.

f) Potential for Wetlands

It has been demonstrated above that the Preserve has mild topographic relief. Natural drainage does occur, although human intervention has altered it by modifications made to the ground surface. Besides the Happy Valley and Nordhoff drains, chief among the modifications is a berm that bisects the Preserve along a north-south axis, from point H to point K in Map 4. According to the Ojai Sanitary District (Correa, *pers. comm.*) a sewer pipe is buried beneath this berm. However, the pipe that is visible at the crossing of the Nordhoff drain is not the sewer pipe (Correa, *pers. comm.*) and it is not known to be of public ownership. Therefore, removal of the berm and removal of the pipe crossing the Nordhoff Drain are both feasible and not likely to complicate the proposed habitat restoration efforts (see Section IV below).

[6] The 25-yr expected annual peak flow and its lower and upper limits are show in Figure 10 to equal 1120, 750 and 1670 $ft^3\ s^{-1}$, respectively.

Due to its mild slopes, the Preserve receives full insolation, except in areas shaded by vegetation. Thus, soil saturation and ponding here must be examined based on the interplay of rainfall, infiltration, drainage, evapotranspiration, and migration of water beneath the ground surface.

Figure 7 shows average monthly precipitation and potential evapotranspiration (ET_0) in the Preserve. The precipitation data originated from the Ventura County Public Works Agency, as reported in Dunbar et al. (2001). The source of ET_0 was the California Reference Evapotranspiration map and tables by Snyder et al. (1999). ET_0 is the amount of water evaporated from soil and transpired by vegetation under prevalent climatic conditions when the soil-water content is not limiting. It differs from actual evapotranspiration (ET_A) in that the latter may be reduced by low water content, which hinders the rate of transpiration and soil-water evaporation relative to potential levels. If ponding or soil saturation exist, the rate of evapotranspiration is represented or approximated by the ET_0.

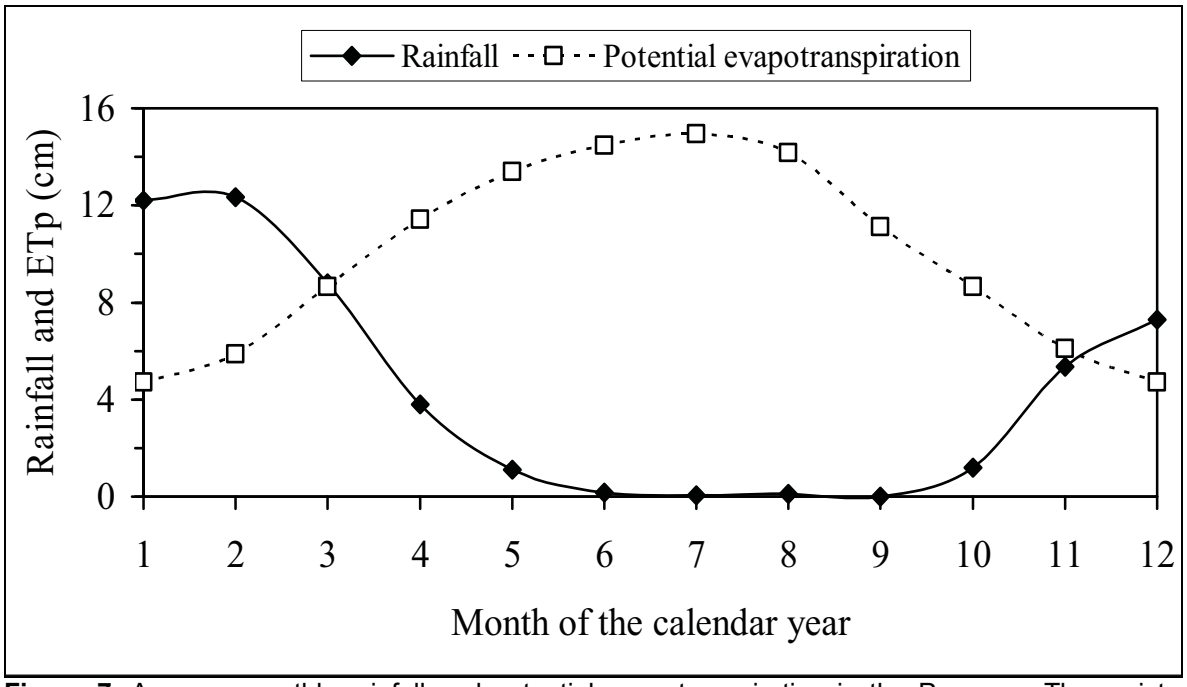


Figure 7. Average monthly rainfall and potential evapotranspiration in the Preserve. The moisture balance is defined as the monthly rainfall minus the monthly evapotranspiration (1 cm = 2.54 inches).

The source of soil water in areas with a deep water table (the Preserve is a case in point) is rainfall, through infiltration. Some of the rainfall infiltrates and is retained in the soil to be eventually evapotranspired, fully or partly, some of it may pond, and the remainder runs off quickly as gravitational drainage overland or as shallow subsurface flow that are captured in channels.

The ponded water that is removed as overland flow may do so slowly because of large surface roughness and small ground slope. The remainder of the ponded water

is consumed by infiltration and evapotranspiration, processes that vary in duration depending on the ponding depth, soil permeability, vegetation, and climatic factors. It follows from these considerations that the moisture balance in a region, herein defined as rainfall (the water supply) minus potential evapotranspiration (the water consumption), is what controls the available water that can be maintained as ponds or as soil moisture that give rise to wetlands once the runoff is deducted. Magney (2001) documented a shallow perched water table (depth of 22 inches below ground level) on a borehole dug on fine sandy loam. The presence of rising perched water tables near ground level would halt infiltration and be conducive to ponding of rainfall water, which, if supplemented by proper ground contouring, could be used advantageously in the creation of artificial localized wetlands within the Preserve.

The data in Figure 7 show that, except for December, January, and February, the moisture balance in the Preserve is negative (potential evapotranspiration substantially exceeds rainfall over the average annual cycle). The implication is that some of the water that may be available during short periods of time during the rainy season (November through April) would be removed by drainage first via the Happy Valley and Nordhoff Drains. The remainder would leave the Preserve by evapotranspiration within a matter of weeks or less. It has been shown above that heavy rainfall floods the Preserve, but most of this water is removed by gravitational drainage within days or weeks, or it infiltrates and is later evapotranspired.

The moisture balance in the Preserve is not propitious for sustaining long-term inundation, and neither is its topographic setting. However, short-term inundation on the order of two to three months is entirely possible and could produce conditions conducive to sustaining wetland as discussed in the restoration plan below. Further insight into the dynamics of water balance in the Preserve can be gained by looking at rainfall-infiltration interactions on an event-by-event basis.

Figure 8 shows infiltration capacity curves and hyetographs (graphs of rainfall over time) for the Preserve. The infiltration curves were developed from data collected by Dr. Loaiciga during double-ring infiltrometer tests in soils of various degrees of permeability: the Sorrento clay, a sandy loam and clay, and a very fine sandy loam. The hyetographs correspond to 24-hr storms with 2-, 25-, and 100-yr return periods and to the 24-hr probable maximum precipitation (PMP), all with temporal distribution Type I (U.S. SCS, 1986). The locations of the infiltrometer tests were labeled as soil-tests T-1, T-2, and T-3 in Map 4. The data collected during the infiltrometer tests were fitted with the Horton 3-parameter infiltration capacity function. The fitted infiltration capacity functions for the very sandy loam (the most permeable soil, test T-2), the sandy loam and clay (the soil with intermediate permeability, test T-1), and the Sorrento clay (low-permeability soil, test T-3) are shown in Figure 8. The vertical shifts among the three infiltration capacity curves in

Figure 8 are remarkably pronounced. This attests to the large differences between the hydraulic properties of soils found within the Preserve.

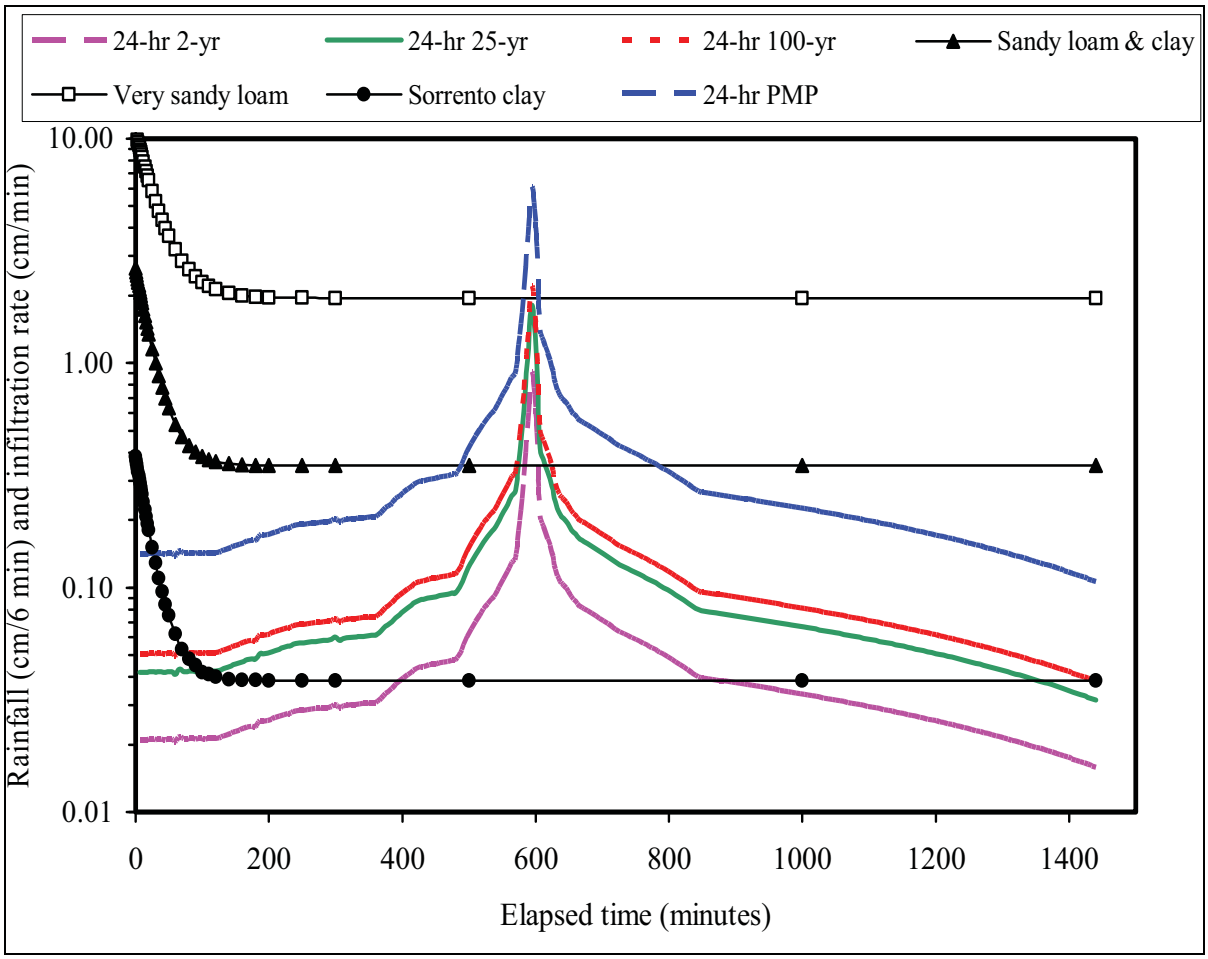


Figure 8. Infiltration capacity curves for three soils and hyetographs for 24-hr storms with a range of return periods (1 cm = 2.54 inches) and temporal distribution Type I.

A key implication of Figure 8 can be drawn by comparing the infiltration capacity curve for the very sandy loam with the four hyetographs. The very sandy loam is predominant within the Preserve (see Map 6) (David Magney Environmental Consulting, 2001; Dunbar et al., 20001). It is evident in Figure 8 that the very sandy loam has enough infiltration capacity to absorb all but the peak rainfall in the PMP hyetograph. In other words, the 2-, 25-, and 100-yr rainfall events would not produce ponding on the very sandy loam. Ponding on the very sandy loam could be produced by extreme rainfall (the PMP) or by overflow of the Happy Valley and Nordhoff drains.

The sandy loam and clay soil is somewhat intermediate between the very sandy loam and the Sorrento clay insofar as its infiltration properties is concerned.

Sorrento clay, on the other hand has a relatively low infiltration capacity (Map 6). In fact, the infiltration is so low that all the rainfall events displayed in Figure 8 would produce ponding on the Sorrento clay. This shows that this area of the Preserve is, in fact, conducive to supporting wetlands, particularly if combined with increased water supply from Happy Valley flow diversions.

Because of the lack of flat terrain within the Preserve at the present time, ponding during heavy rain on Sorrento clay or sandy loam and clay would not remain stagnant; rather, it would give rise to overland flow toward lower lying areas. Ponding and stagnation would require the creation of depressions and berms to confine water on the surface. The water so confined, however, would be depleted by evapotranspiration and (slow) infiltration over periods whose duration would depend on (i) the depth of ponded water, (ii) climatic conditions, (iii) the infiltration capacity of the underlying soil, and (iv) vegetation. Because of the moisture deficit germane to the Preserve, this author contends that artificially ponded, shallow, rain-fed water is likely to be depleted once the rainy season is over, if not sooner, unless ponding is maintained by artificial watering. The latter is a real possibility given the existence of one well within the Preserve that is located near the site of the soil test T-3 (see Map 4), underlain by the Sorrento clay.

F. Biological Setting

This section presents information on historic native landscapes prior to European settlement, and then describes the existing vegetation on the site. Information compiled on historic native landscapes encompasses the distribution and ecology of each native plant community as a whole, along with a tighter focus on what is known historically for each community in the Ojai Valley. Since, to our knowledge, no long-term scientific studies have examined the change in native landscapes in the Ojai area over the past few centuries, a broader examination of ecological literature is utilized to understand local conditions. This background on historic landscapes serves as a foundation for planning the restoration of native plant and animal species and communities on the Ojai Meadows Preserve.

1. Historic Native Landscapes

a) Upland habitats

(1) Native Grasslands

Photo 12: Native Grassland *photography by Mary Carroll*

Vast expanses of grasslands covered many of California's valleys and lowlands in pre-European times, from coastal terraces to the Ojai Valley in Ventura County as well as portions of the Great Central Valley. Unlike the ubiquitous non-native annual grasslands of today, native grasslands prior to 1700 were dominated by clumps of perennial grasses ranging from one to four feet in height interspersed with wildflowers and occasional shrubs and trees. These grasslands included Needle-grass (*Nassella* species), native Fescues (*Festuca* and *Vulpia* species), native Bluegrass (*Poa* species), Three-Awn (*Aristida* species), Melic Grass (*Melica* species), Wild-rye (*Leymus* species), June Grass (*Koeleria* species), Deer Grass (*Muhlenbergia rigens* and related species) and others (Barbour and Major 1977, Barbour et al. 1993, Holland and Kiel 1995). These native perennial grasses do not die in summer; a well-developed root system up to seven or more feet deep (Stromberg and Kephart 2004) allows them to persist during the hot dry months and to continue to occupy the same site from year to year. In patches between the bunchgrasses, annual wildflowers such as California poppy (*Eschscholzia californica* and other species), lupines (*Lupinus* species), owls clover (*Castilleja* species), and a host of other species would grow lush in spring and fade in

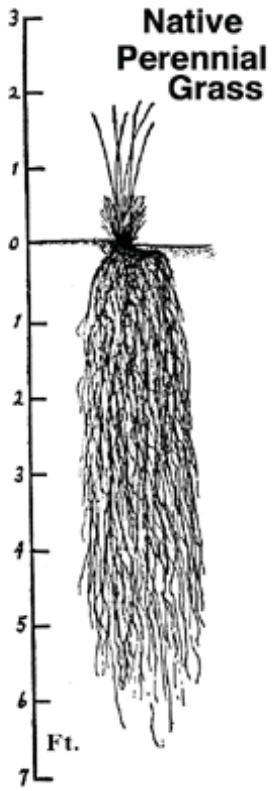


Photo 13: Native Grass Root System *courtesy of Stromberg and Kephart 2004*

summer. Herbaceous perennials, including bulbs, would bloom in spring or summer, depending on the species. In areas such as Ojai, summer-active annuals and herbaceous perennials such as tarweeds (*Madia, Hemizonia*, *Holocarpha* species) would also be present among the grasses, along with patches of Coastal Sage Scrub, including Coastal Sagebrush (*Artemisia californica*), Purple Sage (*Salvia leucophylla*), Black Sage (*Salvia mellifera*), Golden Yarrow (*Eriophyllum confertiflorum*) and many other species. Thus, the original grasslands and oak savannas of the Ojai Valley formed a complex mosaic, with native perennial bunchgrasses forming the foundation, punctuated by annual and perennial forbs, shrubs, and in places with deep soils, oak trees.

Photo 14: Succulent Lupine *photograph by Mary Carroll*

Today, much of the Ojai Valley is dominated by non-native grasses and regeneration of oak trees in the grassland environment is poor. In order to restore the grasslands and oak savannas to conditions found in earlier centuries, an understanding of grassland distribution and formation can be helpful.

Several environmental factors favor grassland formation under natural conditions, the most important of which may be soil and climate. In the past, native grasslands would have occurred in Ojai Valley on heavy clay soils, although native grasslands would sometimes form on loam and gravel as well. Grassland soils may also be underlain with hardpan layers that prevent deep-rooted plants from becoming established. Native grasslands prior to about 1700 also experienced infrequent grazing by native herbivores such as pronghorn antelope and deer that grazed seasonally and then moved on. Wildfires and human-set fires were also a regular component of native grassland ecosystems, reinvigorating a site by providing nutrient-rich ash and clearing out thatch and woody plants. Hence, optimum conditions for herbaceous growth were provided for the following season.

It is estimated that native grasslands blanketed thirteen million acres in California prior to 1700, covering 15% of the state. An additional nine and one-half million acres of oak-grassland habitat occurred in deeper soils. Like much of California, grassland and oak woodlands and savannas were the dominant vegetation in the Ojai Valley prior to 1700. Today, however, there are no large native grasslands in Ojai, or elsewhere in much of California, a legacy of European settlers who brought livestock to graze a given locale year after year, clearing for agriculture and urbanization, type conversion of native grasses to more palatable European annual grasses, fire suppression, and the introduction of vigorous non-native grasses and other weeds that spread and outcompeted native species under conditions of ongoing disturbance. (See discussion on grazing below under Valley Oak Savanna.) Non-native annuals die in summer, whereas native grasses persist; hungry livestock can literally graze a native grass to death during these dry months if the cattle are left with no place else to go (Barbour et al. 1993, Holland and Kiel 1995).

Photo 15: Red Maids on the Ojai Meadows Preserve *photograph by Mary Carroll*

(2) Coast Live Oak Woodland

On north-facing slopes and foothills in the Ojai area, Coast Live Oak Woodlands and Forests have predominated for thousands of years. Although seemingly ubiquitous in the mountains surrounding Ojai, Coast Live Oak (*Quercus agrifolia*) is restricted to a fifty-mile coastal swath from Mendocino County south to northern Baja California. It is completely absent in the Sierra Nevada and other interior ranges; rather, it tends to occur in the maritime belt that receives some fog during the summer months (Hickman 1993, Pavlik et al. 1991).

Photo 16: Coast Live Oak Woodland with diverse understory *photograph by Mary Carroll*

Photo 17: Snowberry in Oak Woodland *photograph by Mary Carroll*

Coast Live Oak Woodland is most well developed between sea level and 5,000 feet on north-facing slopes, in canyons and along rolling foothills and alluvial terraces adjacent to water courses, where roots can reach moisture at depth. Most healthy stands contain mixed age classes of oak trees, saplings, and seedlings. Although considered drought-tolerant due to its ability to survive the hot dry summer months without rain, Coast Live Oak tends to occur in areas that receive at least 15 or more inches of rain or has suitable microenvironments with water available to its roots at depth. In many locations, Coast Live Oak is the only tree species present in Coast Live Oak Woodland, but in the Ojai area, moister sites such as canyons and mesic north-facing slopes also support California Bay (*Umbellularia californica*), Southern California Walnut (*Juglans californica*) and an occasional Bigleaf Maple (*Acer macrophyllum*). Willard Lynn Jepson was so impressed with the Southern California Walnut-Coast Live Oak association in the Ojai Valley back in 1910 that he included a description of it in his manual (Jepson 1910).

Coast Live Oak is an evergreen tree ranging from 40 to 75 feet in height, with a spreading crown, many massive branches, and a dense canopy of thick waxy leaves (Carroll 1989). Trees can easily live for 300 years or more. In dense Coast Live Oak Woodlands, the environment under the oak canopy is very shady. In Ojai, shade-tolerant shrubs such as Toyon (*Heteromeles arbutifolia*), Holly-leaf Cherry (*Prunus ilicifolia*), Poison-oak (*Toxicodendron diversilobum*), Snowberry (*Symphoricarpos mollis*), and currants and gooseberries (*Ribes* species) are common, along with vines such as California Blackberry (*Rubus ursinus*), and herbaceous perennials such as Coastal Wood Fern (*Dryopteris arguta*), Bracken Fern (*Pteridium aquilinum*), Hummingbird Sage (*Salvia spathacea*), Wood Mint (*Stachys bullata*), Humboldt Lily (*Lilium humboldtii*) and others. The understory of pristine Coast Live Oak Woodland consists of woody or herbaceous perennials; annuals are infrequent to absent.

Photo 18: Fuchsia-flowered Gooseberry in Oak Woodland *photograph by Mary Carroll*

In drier environments, including those with rocky or shallow soils and/or more open terrain, Coast Live Oak Woodland may intergrade with Coastal Sage Scrub, Chaparral, and/or native grasslands (in pre-European times). In moister areas in valley bottoms, Coast Live Oak and Valley Oak form mixed stands.

Today in the Ojai Valley, Coast Live Oak Woodland has been altered in urban areas. In general, scattered large oaks are preserved but the understory of Coast Live Oak Woodland is cleared of native vegetation and replaced with non-native annual grasses and forbs or garden ornamentals, producing a related decline in plant and wildlife biodiversity. As a result, reproductive rates of the oaks themselves have declined.

(3) Valley Oak Savanna

In pre-European California, extensive swaths of Valley Oak Savanna covered interior valley bottoms, especially in deep alluvial soils adjacent to water courses. From the Sacramento River south through the Great Central Valley, up valley corridors in the Sierra Nevada and Coast and Transverse Ranges, Valley Oak Savanna was a signature California community indicating deep rich soil in valley bottoms between 100 and 2,000 feet elevation, rarely to as high as 5,000 feet elevation (Carroll 1989).

Photo 19: Valley Oak Savanna *photograph by Mary Carroll*

Descriptions of Valley Oak by early explorers and settlers in California extolled their size and beauty.

> *"…it could only be compared to a park which had originally been closely planted with the true English oak; the underwood …had… been cleared …and left the stately lords of the forest in complete possession of the soil which was covered with luxuriant foliage."*
> *– Captain George Vancouver in the Santa Clara Valley, 1796.* (Pavlik et al. 1991)

> *"The two most remarkable measured twenty-seven feet and nineteen feet in circumference, rose perpendicularly at a (computed) height of sixty feet before expanding its branches and were truly a noble sight." – Captain Edward Belcher, British Navy, on the Sacramento River, 1851.* (Barbour et al. 1993)

Called the 'Monarch of California oaks (Pavlik et al. 1991), Valley Oak (*Quercus lobata*) formed extensive savannas and woodlands in deep alluvial soils, especially adjacent to water courses. Valley Oaks are considered to be the largest North American oak, reaching 100 feet in height at maturity with a rounded crown and

massive branches. Smaller branches may droop at the tips ('weep'). The bark is gray and deeply fissured. The winter deciduous leaves are larger than those of Coast Live Oak and lobed (Carroll 1989). After the trees lose their leaves in autumn, light reaches the ground, facilitating germination of winter annuals under the canopy before leaves emerge in spring.

The roots of Valley Oaks are often tiered, with feeder and "sinker" roots that reach different levels in the soil profile, often two to 10 feet below the soil surface (Thomas 1979). Some roots, especially of young trees, can reach 10 - 60 feet in depth, but most roots are just below the soil surface. Roots may extend out twice as far as the dripline (Thomas 1979). Valley Oak tree density is highest near water courses and lower upslope.

Early visitors to the Ojai Valley remarked on the "dense oak forests" (John Montgomery 1874) and, the "abundance and loveliness of its woods of evergreen oaks" (Charles Nordhoff 1882) (both quotes from Fry 1999). "From the first coming of the Americans the Ojai Valley was noted not only for its fertile soil and abundant feed for cattle, but for its magnificent oak forests which seemed more stately than elsewhere" (Thompson and West 1883). The Ojai Valley was described as being "a huge white and love oak forest that was interspersed with cottonwood and sycamore trees" in the *Ventura Signal* in 1879 (Fry 1999).

Both Coast Live Oak, described in the previous section, and the Valley Oak are found today in the Ojai Valley, and the 19th century accounts of Ojai vegetation described the two species together forming a vast forest. Typically, Coast Live Oak occurs on north-facing slopes and in well-drained soils, whereas Valley Oaks thrive in deep alluvial soils with a high water table, such as valley bottoms. Transitional environments support both oak species, such as at the Ojai Meadows Preserve, the nearby Nordhoff Cemetery (0.6 miles from Preserve), and elsewhere.

Valley Oak Savanna was well developed in the Ojai Valley prior to 1700, and would have been dominated by individuals of Valley Oak with tree crowns rarely touching or overlapping, unlike the dense woodlands and forests of Coast Live Oak on nearby slopes. These majestic Valley Oaks often grew in association with native grassland species, scattered herbaceous perennials and occasional shrubs.

Little of the extensive Valley Oak Savannas remain, either in Ojai or elsewhere in the state, and Valley Oak Woodlands and Savannas are designated by California Department of Fish and Game as sensitive habitat. The decline of Valley Oak Savanna is not always obvious, since trees live to be 400 or even 600 years old under optimal conditions. As a result, the scattering of older trees in an area may belie a deeper problem – that Valley Oak habitat is diminishing and the trees are not replacing themselves in most areas in California.

One obvious factor contributing to the decline of Valley Oak Savanna is loss of undisturbed habitat. Early pioneers, along with modern farmers and vintners, were quick to realize the obvious – that Valley Oak Savanna occurs on prime agricultural land, in fertile valley soils near a permanent water source. Tilling and other agricultural practices remove oak seedlings and provide optimal conditions for weed establishment. Furthermore, regions supporting Valley Oak Savanna have been settled and developed at a rapid rate throughout the state (e.g. Sacramento, Fresno, Thousand Oaks) destroying much of the remaining Valley Oak Savanna in the State.

Low-intensity cattle grazing (whereby small numbers of cattle are allowed to graze over large areas for months at a time) has been a common practice in oak savannas for 150 years. In addition to munching on seedlings after all of the green grass is eaten and thus interfering with survival of new seedlings, cattle can compact the soil over long periods of time, which further inhibits germination (Pavlik et al. 1991). However, high-intensity grazing (whereby large numbers of cattle are allowed to graze over a small area for short periods of time limited to one or two days) has been shown to increase regeneration of Valley Oaks and native grassland species such as *Nassella pulchra* (Gevirtz, *pers. observation*, Blair *pers. comm.*). This regeneration may be attributable to stimulation of new growth of the grasses in response to short-term disturbance and predation by cattle, an animal palate that favors soft and sweet grasses, over the tougher and less sweet leaves of young oak seedlings, intense short-term nutrient inputs from animal feces and urine, and increased water retention by the long roots of the native perennial grasses.

Photo 20: Owl's Clover *photograph by Mary Carroll*

Some problems stemming from human modifications of oak ecosystems have been subtle. Since the 1800s, many trees have been cut, reducing oak population densities and sources for seedling establishment. Even when large oaks are left in place in agricultural fields, as they have been at Ojai Meadows Preserve, there is often little to no reproduction. Part of the reason is removal of seedlings by tilling, but the disturbance of soil layers also enhances conditions for colonization by gophers and ground squirrels that eat most seedlings (Barbour and Major 1977). Non-native grasses and forbs compete for moisture, nutrients and space, and may produce allelopathic toxins that inhibit the growth of oak seedlings. Browsing deer finish off the survivors in many areas.

Photo 21: Valley Oak Sapling at Ojai Meadows Preserve *photograph by Mary Carroll*

Drawing down of the water table by wells also has impacted the Valley Oak, which depends on water availability below the ground surface during the dry summer months. The Valley Oak Savanna of today stands in contrast to the original; few to no seedlings are present throughout much of California, and one by one, the giant oaks fall amidst the weedy grasses and forbs surrounding them.

Historically, Valley Oak Savanna intergraded with Coast Live Oak Woodland at the Ojai Meadows Preserve. Trees, saplings and seedlings of different age classes would be typical of healthy stands. Hence, the presence today of Valley Oak seedlings and saplings at the Preserve is an incredible resource and, coupled with careful monitoring, will provide invaluable information to land managers throughout Ojai and the state who are intent on oak conservation.

(4) Coastal Sage Scrub

Although Coastal Sage Scrub is not found as a discrete community at the Ojai Meadows Preserve today, clumps of Coyote Bush (*Baccharis pilularis*) are present, and records of Coastal Sagebrush (*Artemisia californica*) have been reported (Dunbar et al. 2001, Magney *pers. comm.*). Furthermore, extensive patches of Coastal Sage Scrub cover portions of Krotona Hill and are also visible in historic aerial photographs of the Ojai Valley region.

Photo 22: Coastal Sage Scrub *photograph by Mary Carroll*

Coastal Sage Scrub is a natural component of the foothill ecosystems of Ojai Valley and is still found nearby. Species representative of Coastal Sage Scrub were likely found on mounds of well-drained sandy loams on the Ojai Meadows Preserve prior to 1700, including Coyote Bush (*Baccharis pilularis*), Coastal Sagebrush (*Artemisia californica*), Sage (*Salvia* species), Golden Yarrow (*Eriophyllum confertiflorum*) and many other species.

In general, Costal Sage Scrub is dominated by extremely drought-tolerant, soft-leaved shrubs that are summer dormant and winter active, exhibiting a huge burst of growth in the winter and spring months. Many species are partially or completely summer deciduous. Two species, Coyote Brush and Coastal Sagebrush, are particularly tolerant of disturbance and may reinvade sites that have been previously cleared of scrub or grassland vegetation. Wildfire is a regular component of natural Coastal Scrub ecosystems (Barbour and Major 1977). Magney (1988, 2001) reports that 'Coyote Brush Scrub' was found at the Ojai Meadows Preserve but was cleared during the last decade for fire prevention purposes.

b) Wetland Habitats

Unlike upland environments in the Ojai area, which are often strongly influenced by the summer-dry winter-wet Mediterranean climate regime, wetland habitats experience water saturation for some or all of the year. In fact, in wetland environments, water saturation is the dominant factor determining the nature of soil development and the types of plant and animal communities that are present.

(1) Definition, Regulation, and Types of Wetlands

The U.S. Fish and Wildlife Service has adopted the following definition for wetlands from Cowardin (1979): "Wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water… Wetlands must have one or more of the following three attributes: (1) at least periodically, the land supports hydrophytes, (2) the substrate is predominantly undrained hydric soil; and (3) the substrate is non-soil and is saturated with water or covered by shallow water at some time during the growing season of each year ."

Wetlands are the subject of considerable study and are regulated by various agencies, including the United States Fish and Wildlife Service, US Army Corps of Engineers, California Department of Fish and Game and regional entities. The extent of wetlands in California was considerable prior to European contact, and included lakes, ponds, rivers, riparian habitats, wet meadows and pastures, springs and seeps, swamps, freshwater and saltwater marshes, bogs, vernal pools, and saltflats and mudflats.

There are many classification systems used by scientists to characterize wetland vegetation. Cowardin et al. (1979) and Ferren et al. (1996) focus on five major ecological systems, two of which are found at Ojai Meadows Preserve, palustrine and riverine wetlands. In general, palustrine wetlands are by far the most abundant, and are characterized by greater than 30% cover by persistent vegetation, including herbs, shrubs and trees. Riparian woodland, freshwater marsh, wet meadows, and vernal pools are all types of palustrine wetlands. Riverine wetlands occur adjacent to a channel or river in which water is flowing, when present; persistent vegetation

occupies less than 30% of the substrate and is typified by ephemeral river bars, intermittent unconsolidated shores along streams, boulder strewn-areas with little vegetation, and algae-covered areas of waterfalls.

(2) Functions of Wetlands

Wetlands are important ecosystems that function as natural sponges that trap and slowly release water, facilitating ground-water recharge. The roots of trees, shrubs, and other wetland plants slow the speed of flood waters and thus reduce erosion. Wetlands within and downstream of urban areas are particularly valuable, counteracting the greatly increased rate and volume of surface-water runoff from pavement and buildings. Wetland plants improve water quality by absorbing excess nutrients and pollutants and by trapping sediments. In fact, wetland habitats are among the most productive environments, in terms of carbon gain, of any ecosystem in the world, especially the cattail marsh (Barbour and Major 1977). Furthermore, many animals and plants depend on wetlands for food and shelter, and regional biodiversity is often highest in wetland environments. The plants of wetland habitats are almost always different from adjacent areas, and the presence of year-round water allows them to be more productive. Many animals are restricted to wetlands as well. More than one-third of the endangered species in the U.S. live only in wetlands.

Photo 23: Mallard Ducks at Ojai Meadows Preserve *photograph by Mary Carroll*

(3) Wetland Loss

Approximately four to five million acres of wetlands existed in California prior to European settlement, of which only 10% remains (Holland and Keil 1995). Most of the wetlands of the Ojai Valley have been altered. Streams have been channelized, and lakes, ponds and meadows have been drained (see history of the Ojai Meadows Preserve below). Of extant wetlands, most are severely degraded. As a result, there have been sharp drops in wetland species and habitat diversity as well as a decline in water quality. Among the factors contributing to wetland loss in the Ojai Valley have been agricultural clearing and draining; flood control activities, including channelization of streams; construction of dams and other stream and river modifications; urbanization; land use changes adjacent to wetlands; wells drawing down the water table; pollution; trampling by livestock; and introduction of invasive species.

(4) Wetlands of the Ojai Valley

Freshwater Wetlands, including Freshwater Marsh, Wet Meadows, and Vernal Pools

Photo 24: Fresh Water Marsh and Riparian Scrub
photograph by Mary Carroll

Freshwater wetlands are extremely complex and variable, and their species composition and overall structure are dependent on a number of factors. Water depth, seasonal fluctuations in water levels, rate of water movement, water and sediment chemistry (including salinity, pH, and quantity organic matter), depth and texture of bottom sediments, amount of sunlight, and water and air temperatures are among the most important variables affecting overall wetland dynamics.

Water depth has a profound affect on species composition. In deep open water, especially if there is some flow, only floating aquatic plants may occur, such as Duckweed (*Lemna* species). As water diminishes in depth towards shore, submersed or emergent rooted aquatic species may become established; emergent plants are rooted below the water with leaves, stems, and flowers above the water. In the Ojai Valley, Water Smart Weed (*Polygonum amphibium*), Water-plantain (*Alisma plantago-aquatica*), and Arrowhead (*Sagittaria* species) are just a few of many emergent aquatics that were found in historic wetlands, rooted a few feet below the water's surface in ponds and marshes.

Photo 25: Cattails at Ojai Meadows Preserve
photograph by Mary Carroll

In shallow water near shore, emergent vegetation may flourish. Colonies of perennial wetland monocots such as Cattail (*Typha domingensis, T. latifolia*), California Bulrush or Tule (*Scirpus californicus*), Common Spikerush (*Eleocharis macrostachya*), and Rush (*Juncus* species) may form in sunny habitats. Shrubs, especially willows (*Salix* species), may be common along with an array of annuals

and herbaceous perennials, including Common Monkeyflower (*Mimulus guttatus*), Scarlet Monkeyflower (*M. cardinalis*), Water Cress (*Rorippa nasturtium-aquatica),* Speedwell (*Veronica anagallis-aquatica*), Willow-herb (*Epilobium brachycarpum*), and others. In places where willows and other woody shrubs and trees are dense, cover by emergent aquatics will decline, especially the colonial monocots.

Fluctuations in water level have a major impact on wetland plants and may inhibit the establishment of some wetland species. Some wetland habitats, such as vernal pools, are seasonal wetlands with an entire flora and fauna that are tolerant of such fluctuations (more below).

Water flow rates produce differing conditions that affect species composition as well. Swift moving water is well aerated and can inhibit the establishment of many plants; only those that are anchored in the ground and are flexible enough to endure torrents of rushing water during flooding conditions survive. The stream bottom is swept clean of organic matter and fine sediments. In contrast, slowly moving or standing water may be poorly aerated or anaerobic unless there is a continual source of fresh aerated water. Organic matter settles on the bottom and nourishes a range of wetland species that tolerate anaerobic conditions.

Nutrient cycling in freshwater wetlands depends on many factors, including pH, temperature, and interactions of various organisms. Excessive nutrients, especially phosphorus and nitrogen, can promote algal blooms that reduce light availability to submerged aquatics and deplete oxygen. At the same time, some wetland species are extremely effective at filtering and removing excess nutrients and pollutants from the surrounding water and can serve as biological filters (Barbour and Major 1977, Barbour et al. 1993, Holland and Kiel 1995).

Freshwater marsh vegetation may be found along pond and lake margins, as well as in smaller bodies of water, as long as there is standing water all year. In addition, freshwater marsh vegetation may become established along level stretches of rivers and creeks where water flow is sluggish. Marsh vegetation does not tend to be limited by altitude; rather it flourishes in nutrient-rich soils that are saturated year-round. Marsh soils are often anaerobic; as a result, marsh species have adaptations such as hollow stems or special porous tissue that conducts air to the root zone.

Photo 26: Tule in Fresh Water Marsh Habitat at Ojai Meadows Preserve *photograph by Mary Carroll*

Freshwater marsh vegetation was found historically in many locations in the Ojai Valley and was well developed at Mirror Lake and at the historic wetland at the Ojai Meadows Preserve. Remnants occur today along the Nordhoff Drain, Happy Valley Drain, and the outflow by Nordhoff High School (which was once a small natural drainage). A minor amount of non-native wetland vegetation is also found at the outflow from the Taormina communitiy.

Wet meadows occur on permanently moist soil and are dominated by perennial grasses, sedges (*Carex* species), spikerushes (*Eleocharis* species) and rushes (*Juncus* species). These meadows may be wet to moist all year. Sometimes moisture is retained at the root zone while the soil surface becomes cracked and hard. As a result, goldenrods (*Solidago* species, *Euthamia occidentalis*), tarweeds (*Madia, Holocarpha, Hemizonia* species) and other annuals and perennials may become the dominant vegetation during the summer months and die back to the ground in winter, whereas the grasses, sedges, and rushes may be winter active and turn brown in summer.

Photo 27: Wet Meadow at Santa Ana Creek *photograph by Mary Carroll*

Wet meadows were scattered along low-lying water courses and seeps throughout the Ojai Valley historically, and were probably found adjacent to the large historic wetland at Ojai Meadows Preserve. Remnants are found along both the Nordhoff and Happy Valley Drains. One example of a more intact wetland in the Ojai area is near Santa Ana Creek, north of Lake Casitas and Highway 150 (Maps 1 and 3).

Vernal pools are seasonal wetlands that occupy depressions underlain by hardpan or other impermeable layers, usually in grassland and woodland areas. Fall and winter precipitation fills the pools with water, which stimulates herbaceous aquatic or emergent plants to germinate and/or emerge from dormancy and begin to grow. As water begins to evaporate, flowering is stimulated, and seed set is usually made in caked, hard mud. Most vernal pool species are annuals, although perennial herbs are also common. Shrubs and trees are absent. Species composition varies markedly from pool to pool and region to region, and each pool acts effectively as an island. Like the grassland they often occur in, vernal pools are disappearing at a rapid rate, often due to agricultural activities and urbanization.

Wetland species often found in vernal pools or vernal environments at the edges of wet meadows that have been recorded for the Ojai area include American Pillwort (*Pilularia americana*), Howell's Quillwort (*Isoetes howellii*), and Common Water-nymph (*Najas guadalupensis*); all of these were known from Mirror Lake (which was not a vernal pool but did have vernal environments at the margins) prior to 1979, when the size of Mirror Lake was drastically reduced due to development.

Photo 28: Mirror Lake 2004 *photograph by Mary Carroll*

Small seasonal pools are found in non-native grassland at the Ojai Meadows Preserve east of Nordhoff Drain after winter rains. However, no vernal pool species are found within the pools in the Preserve. The presence of a freshwater copepod (Cyclops) is reported for a pool on the "Palmer property" Dunbar et al. (2001).

Riparian Woodland

Many streams, lakes, ponds, and springs throughout California, as well as in the Ojai area, are bordered by clumps or forests of deciduous trees and large swaths of perennial and shrubby species that thrive in soils that are seasonally to permanently wet. The extent and type of wetland vegetation adjacent to the water source depend on the size and flow of water over time, the size and nature of banks and flood plains, the amount of water carried on a seasonal and annual basis, soil type and permeability, availability of oxygen in the soil, and the depth and lateral extent of subterranean aquifers.

Photo 29: Bigleaf Maple *photograph by Mary Carroll*

Substrates in riparian habitats vary, from large boulders and course particles where water movement is swift to fine-grained particles in areas with slower water movement. Meandering stream channels reduce the speed of water flow, redistribute sediments, and trap organic matter from upstream as well as onsite, contributing to high nutrient levels.

The environmental conditions of riparian habitats often contrast with those of surrounding vegetation. In winter, the riparian trees and shrubs are largely dormant and leafless, whereas plants in surrounding grasslands and shrublands are often growing or even flowering during the winter period. Direct light can reach the ground, enabling understory and nearby wetland plants that are winter- active to receive a boost in photosynthetic potential. Most woody plants in the riparian zone are wind pollinated and flower before they leaf out.

Once a green canopy has formed, dense shade is produced. Temperatures are moderated and are often significantly cooler than in full sunlight. Humidity is higher than in full sun due to evaporation from soil and transpiration from trees, shrubs, and herbs. Wind velocities are reduced under the canopy. Thus, the riparian habitat is more mesic than surrounding areas and serves as a magnet for wildlife. Further, by summer much of the surrounding vegetation may be transitioning into a dormant state due to drought stress whereas plants in the riparian habitat receive ample moisture and are fully active.

One of the characteristics of healthy Riparian Woodland is the development of multiple layers of vegetation – an overstory of large trees; smaller trees and large shrubs underneath or in openings; shrubs, vines, ferns, and herbaceous perennials lining banks or occupying sandbars or pockets of stable sediments in the stream channel; colonies of herbaceous perennials in favorable sites; and smaller herbs on sandbars and in sunny openings. Plants vary in their ability to tolerate periodic flooding and changing water levels and their distribution within a riparian habitat will fluctuate accordingly.

Photo 30: Riparian Woodland with Sycamores *photograph by Mary Carroll*

In the Ojai area, many water courses originating from surrounding mountain ranges feed into the Ojai Valley. Extensive Riparian Woodlands developed along these streams, dominated by winter deciduous trees such as Arroyo Willow (*Salix lasiolepis*), Red Willow (*S. laevigata*), Yellow Willow (*S. lucida* subsp *lasiandra*), Western Sycamore (*Platanus racemosa*), White Alder (*Alnus rhombifolia*), Fremont Cottonwood (*Populus fremontii*), Southern California Black Walnut (*Juglans californica*) and Valley Oak (*Quercus lobata*). Shrubs include Mule-fat (*Baccharis salicifolia*), Mexican Elderberry (*Sambucus mexicana*), Poison-oak (*Toxicodendron diversilobum*), California Wild Rose (*Rosa californica*) and the viny Creek Clematis (*Clematis ligusticifolia*) and California Blackberry *(Rubus ursinus*). Perennial wetland monocots such as Cattail (*Typha*

domingensis, T. latifolia), California Bulrush (*Scirpus californicus*), Common Spikerush (*Eleocharis macrostachya*) and Rush (*Juncus* species) may form colonies in sunny openings in slow-moving water and in backwater areas. Individuals of Giant Chain Fern (*Woodwardia fimbriata*) may be scattered up and down the corridor in partly sunny environments. A wide variety of plants will grow in the exposed stream channels, including Water Cress (*Rorippa nasturtium-aquatica),* Speedwell (*Veronica anagallis-aquatica*), Common Monkeyflower (*Mimulus guttatus*), Willow-herb (*Epilobium brachycarpum*), and others.

Riparian habitats support the most diverse and densest aggregations of wildlife in the region due to the diversity of plant species, multilayered vegetation, and perennial water that provide food and habitat for wildlife. Riparian Woodland is visible in the 1929 aerial photograph and is present in a severely degraded form today (see Map 8).

1. Land-use Changes

Native peoples have had thriving cultures in the Ojai Valley dating back at least 10,000 years. First the Oak Grove People and later the Chumash lived in the valley continuously. Although Native Peoples are often described as passive users of the land, the Chumash were skilled in manipulating their environment, including pruning and cutting back plants, as well as burning certain habitats to increase food and fiber production (Timbrook et al. 1982, Blackburn and Anderson 1993).

Chumash villages in the Ojai Valley were present in 1837 when Fernando Tico received the upper and lower Ojai valley in a land grant from the Mexican governor, Juan B. Alvarado; Tico's father had served in the Mexican military. He began raising cattle and planting crops at Rancho Ojay and sold the land to an American, Henry Carnes, in 1853 (Weinmann 1997, Thompson and West 1883). Numerous changes in ownership ensued, and the region continued to be called 'the Ojai.' The actual town of Ojai was laid out in 1873, although it took years to complete the process. (The town was initially named Nordhoff (from 1872 to 1917), in honor of Charles Nordhoff, a writer who extolled the beauty of the California landscape in his book "*California for Health, Pleasure and Residence: A Book for Travelers and Settlers*" and his writings for the New York *Tribune* (Thompson and West 1883).

Early historical accounts describe the Ojai area as being forested. "From the first coming of the Americans the Ojai Valley was noted not only for its fertile soil and abundant feed for cattle, but for its magnificent oak forests which seemed more stately than elsewhere" (Thompson and West 1883). Nearby Santa Ana Rancho was also described - "Nearly 10,000 acres of this vast forested region would be good arable land if cleared of the timber…It is a region of forests; the timber is majestic in girth with wide-spreading branches" (Thompson and West 1883). Wildlife included "California lions, wild cats and coyotes" and John T. Stow reputedly killed a "dozen or more grizzlies during one winter" in 1864 (Thompson and West 1883). Historical accounts mention that "Artesian water is obtained at Nordhoff;" and flooding in the region is described in some detail, including well data that indicate flood debris in the Ojai Valley at a depth of 100 feet (Thompson and West 1883).

In 1876, farmland was created from a large oak grove described as being "one of the largest stands of oaks on flat ground" in the Meiners Oaks area (Fry 1999). A combination of agricultural activities, oil exploration, and urbanization gradually transformed the region from one of native oak groves and grasslands to its present condition. In particular, clearing the land for farming and changing drainage patterns had dramatic impacts on natural vegetation and wildlife.

Aerial photographs reveal clearing and filling in of drainages, completely obliterating them from the landscape (see below). Intensive use of ground water pumped from agricultural wells resulted in a lowering of the water table. Wells began going dry in the 1930s, forcing the construction of Matilija Dam in 1949 to replenish groundwater basins and serve as a municipal supply for Ojai and Ventura (Latousek 1995).

As the area became more settled, housing developments spread across alluvial areas and former woodlands and drainages. Mirror Lake, 1.6 miles south of the Ojai Meadows Preserve, (see Map 1 and 3) was well-known as a remarkable wetland to early botanists, and one of the only known sites of a rare species of Arrowhead, Sanford's Arrowhead (*Sagittaria sanfordii*). (Sanford's Arrowhead is endemic to freshwater marshes in California and only known historically from a handful of localities in southern California. Other known sites for this species are located in the Great Central Valley. Today it is listed as very rare (1B) by the California Native Plant Society and is extirpated in southern California and rare in the Central Valley). When the Mirror Lake area was developed in 1979, this population was wiped out, along with other regionally rare populations of Hairy Pepperwort (*Marsilea vestita),* American Pillwort (*Pilularia americana),* Quillwort (*Isoetes howellii*) and other species.

Photo 31: Sanford's Arrowhead
courtesy of CalPhotos

a) History of Ojai Meadows Preserve Property

The Ojai Meadows Preserve is comprised of 57.17 acres of land between the City of Ojai and the unincorporated community of Meiners Oaks. Two contiguous parcels form the Preserve, "Besant Meadows" (25.4 acres) and the "Palmer Property" (31.77 acres).

"Besant Meadows" was purchased as part of larger holdings in the Krotona Hill area by Theosophist Dr. Annie Besant in 1927 to 'provide for an eclectic community devoted to artistic, agricultural, and educational projects', and was originally called 'Star Land' (ojaifoundation.org). Plans were made to develop an institute of higher education and promote the teachings of Jiddu Krishnamurti, although he later decided not to adhere to the original plans. A trust, the Happy Valley Foundation, held title to the land and several dwelling units were located on the site.

Photo 32: Eucalyptus at Ojai Meadows Preserve
photograph by Katrina Burton

In 1946, the Happy Valley School was established immediately adjacent to the current preserve boundary by several educators (including Aldous Huxley and Krishnamurti) to promote a 'Socratic and non-competitive learning experience' (ojaifoundation.org). This school later became the Meiners Oaks Elementary School. In the mid 1950s, Frank Noyes, school gardener, and a group of students planted many species of *Eucalyptus* in a large grove (on what is now the Ojai Meadows Preserve), a popular activity in that era to promote appreciation of trees and involve students in a planting project (Magney 1988, Fry 1999). However, the water demands of the large trees have reduced standing water in the area of the former wetland and biodiversity has decreased due to allelopathic (toxicity of the oils in the leaves to other plants) features of *Eucalyptus*.

Later development plans for "Besant Meadows" included a freeway offramp, a housing subdivision, and a senior condominium project before the land was rezoned as open space in June 1995 and purchased by the Ojai Valley Land Conservancy in 1999. Previously, the site had been described as "extremely critical feeding habitat" for seven species of raptors – Red-shouldered Hawk, Red-tailed Hawk, American Kestrel, Northern Harrier, Barn Owl, Great-horned Owl and White-tailed Kite by the Ventura Audubon Society (O'neill no date). California Department of Fish and Game biologists described the *Eucalyptus* grove on site as significant raptor habitat in a report dated March 5, 1986. Correspondence associated with a proposed development (1988) and a grant application for the State of California Hazard Mitigation Grant Program (1996) describe the site as containing wetlands.

The "Palmer property" was originally owned by the Sage family, and inherited by Ed Carty Sr., a former Mayor of Oxnard and a Ventura County politician. The Carty family became partners with Howard Palmer of Ojai Investments, Inc., which hoped to develop a shopping center and/or housing development. Lengthy hearings and litigations ensued (Palmer v. City of Ojai 1986), and the property was never developed. Later plans for a drug store and a road that bisected the property were also defeated before the Ojai Valley Land Conservancy launched a capital campaign during 1999 and 2000 that resulted in

the purchase of both Besant Meadows and the Palmer property, forming the Ojai Meadows Preserve.

(1) The Historic Wetland, its Sources and Modifications

A large wetland (4.53 acres) is visible in a May 9, 1929 aerial photograph (Photo 33 and Map 8). The photograph showing a wetland is particularly remarkable given that it was taken after the rainy season and that precipitation records for the Ojai area in the previous two winters indicate lower than normal rainfall (14.27 inches in 1927-1928; and 13.17 inches in 1928-1929) (Station 59 - Thatcher School Weather Data 1915-2002).

Photo 33: Historic wetland at Ojai Meadows Preserve, 1929

In 1929 the primary drainage entering the wetland on the Preserve site originated north of today's Preserve boundaries. This unnamed drainage descends from a small ridge (1,000 feet elevation) between McDonald Canyon and Stewart Canyon and then feeds into the site (see Photo 34 and 35). McDonald Creek, just to the north of this unnamed drainage, descends down an east-west ridge about 2,000 feet in elevation that is part of the southern slopes of Nordhoff Ridge. The lower reaches of this creek were later rerouted north of the town of Meiners Oaks during construction of Highway 33 (Blakely, *pers. comm.*)

Additional small drainages from the northeast (today, the Cuyama Meadows property) and east (today, the Nordoff High School property) also entered this wetland.

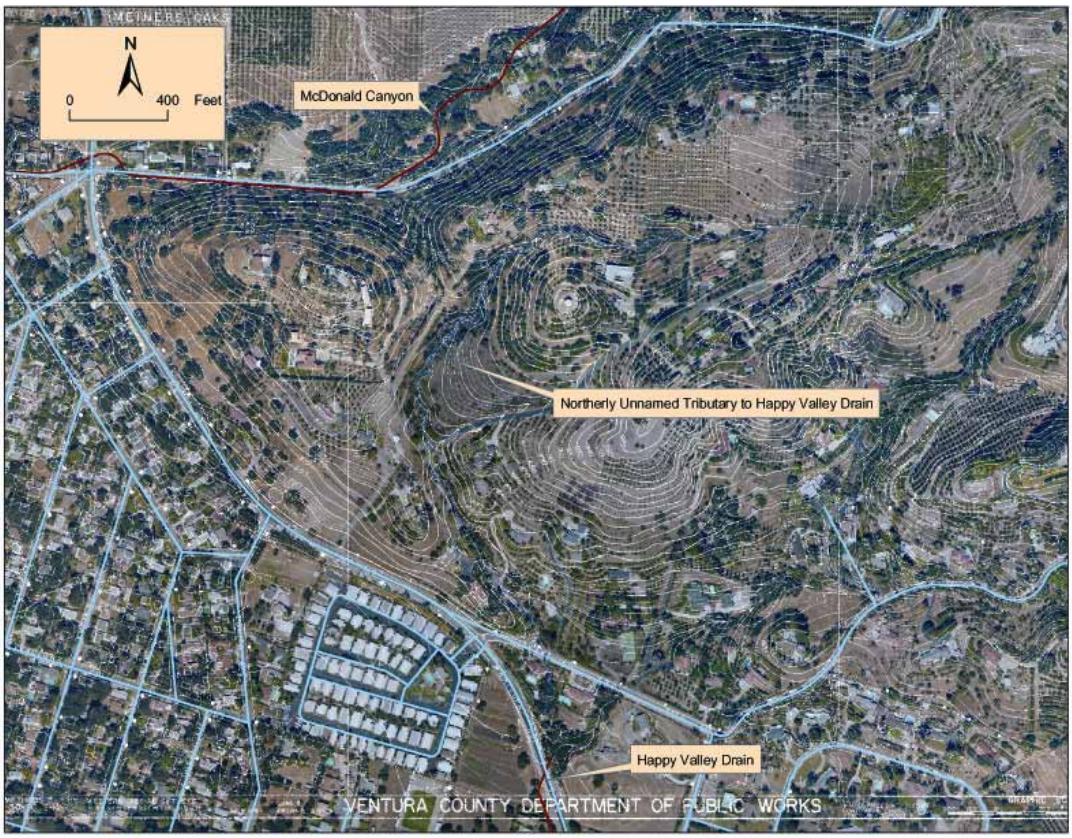


Photo 34: Aerial View of Source of Northerly Unnamed Tributaries to Happy Valley Drain *courtesy of David Laak, Ventura County Watershed Protection District*

The Ojai Meadows Preserve property is described as a drained lake bed and a migratory bird stop in a 1996 grant application for the State of California Hazard Mitigation Grant Program. Warren Glazer, who grew up in Ojai, remembers taking his boat out on the wetland, and cattails lining the margins (Handley *pers. comm*.). A historical account of a small lake on the 'Palmer' property was documented in an interview of long-time resident Elbert Quimby conducted in 1981. Mr. Quimby suggested that the then-owner Ed Carty donate the lake to the city and have it named Carty Lake (Handley, *pers. comm*.).

The construction of Maricopa Highway (Highway 33) along a portion of the northern perimeter of the site in 1933 almost surely involved alteration of drainages to deter flooding. The aerial photograph of 1945 reveals that the large wetland had been drained and/or filled in, although the natural watercourses that entered the Preserve were extant at that time.

Matilija Junior High School was built to the east of the Preserve in 1959 and in 1966 became Nordhoff High School. Construction of the school on a site

dissected by natural drainage channels has probably contributed to the flooding problems experienced by the school.

Water covered the entire site after the torrential storms of 1969 according to Allen Hooker, who at that time was the owner of the nearby Ranch House Restaurant (Handley *pers. comm.*).

Beginning in 1964 and continuing over the next 25 years, segments of the Happy Valley Drain were constructed to alleviate flooding in the vicinity of Highway 33, Meiners Oaks and the Ojai Meadows Preserve, especially after the winter of 1969 (Ventura County Waterhsed Protection District '*As built dates*,' Happy Valley Drain; David Laak, Hydrologist, Ventura County Watershed Protection District, *pers. comm.*).

Today, water from the unnamed drainage to the northeast of the Preserve enters the Happy Valley Drain just north of Highway 33, where it is carried through the Preserve property (Photos 33 and 35). The channel is cement lined until it enters the Preserve. The segment through the Preserve (Units IV,V and VI) were built in 1987 and 1988 and remain earthen due to environmental laws in place at the time of its construction (David Laak, Hydrologist, and Dolores Taylor, retired Senior Hydrologist for the Ventura County Watershed Protection District, *pers. comm.*). Once the Happy Valley Drain exits the Preserve, it becomes a cement-lined channel again.

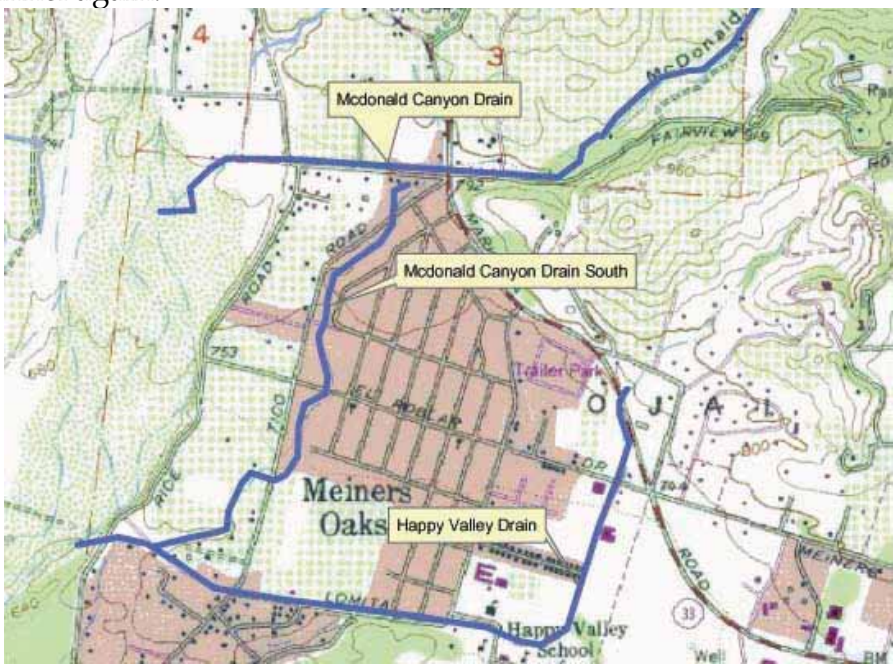


Photo 35: Happy Valley Drain route *courtesy of David Laak, Ventura County Watershed Protection District*

At some point after the 1969 floods, a berm was built on the property to the east of the *Eucalyptus* grove and along the eastern edge of the Nordhoff drain, perhaps for flood control purposes (Belnap 2004). Houses on El Camino Drive and Besant Road experienced structural damage during the winter of 1969 (Handley, *pers. comm*.), and the berm may have been constructed to divert water away from these houses and toward the east side of the Preserve property.

After these flood control measures were implemented, water continued to pool at the site of the historic wetland during the rainy season, but flooding was only an issue for neighbors and public agencies during very wet winters. During storm events in 1993 and 1995, severe flooding onsite resulted in $1,500,722 in damage to roads, bridges and water wells and an additional $1,500,000 in damage to homes, businesses, and a recreational vehicle park (Ojai Valley Land Conservancy 1996). Personal accounts of the floods of 1995-1996 describe water flowing steadily from the high school through the *Eucalyptus* grove, filling the Nordhoff Drain. The Happy Valley Drain overflowed its banks, and children were observed playing in inner tubes by the *Eucalyptus* grove (Handley, *pers. comm.*).

Small seasonal pools continue to form in non-native grassland at the Ojai Meadows Preserve east of Nordhoff Drain after winter rains (Photos 36 and 37). However, except during periods of heavy rainfall, the historic wetland has disappeared and natural drainages entering the Preserve have been transformed into modern flood control ditches and channels.

Photo 36: Seasonal pool at Ojai Meadows Preserve, March 2004 *photograph by Mary Carroll*

Photo 37: Seasonal pool at Ojai Meadows Preserve, March 2004 *photograph by Mary Carroll*

(2) Historic Aerial Photographs of Ojai Meadows Preserve

An examination of early aerial photographs of the Ojai Meadows Preserve property tells a compelling story of land-use change (Maps 8-13).

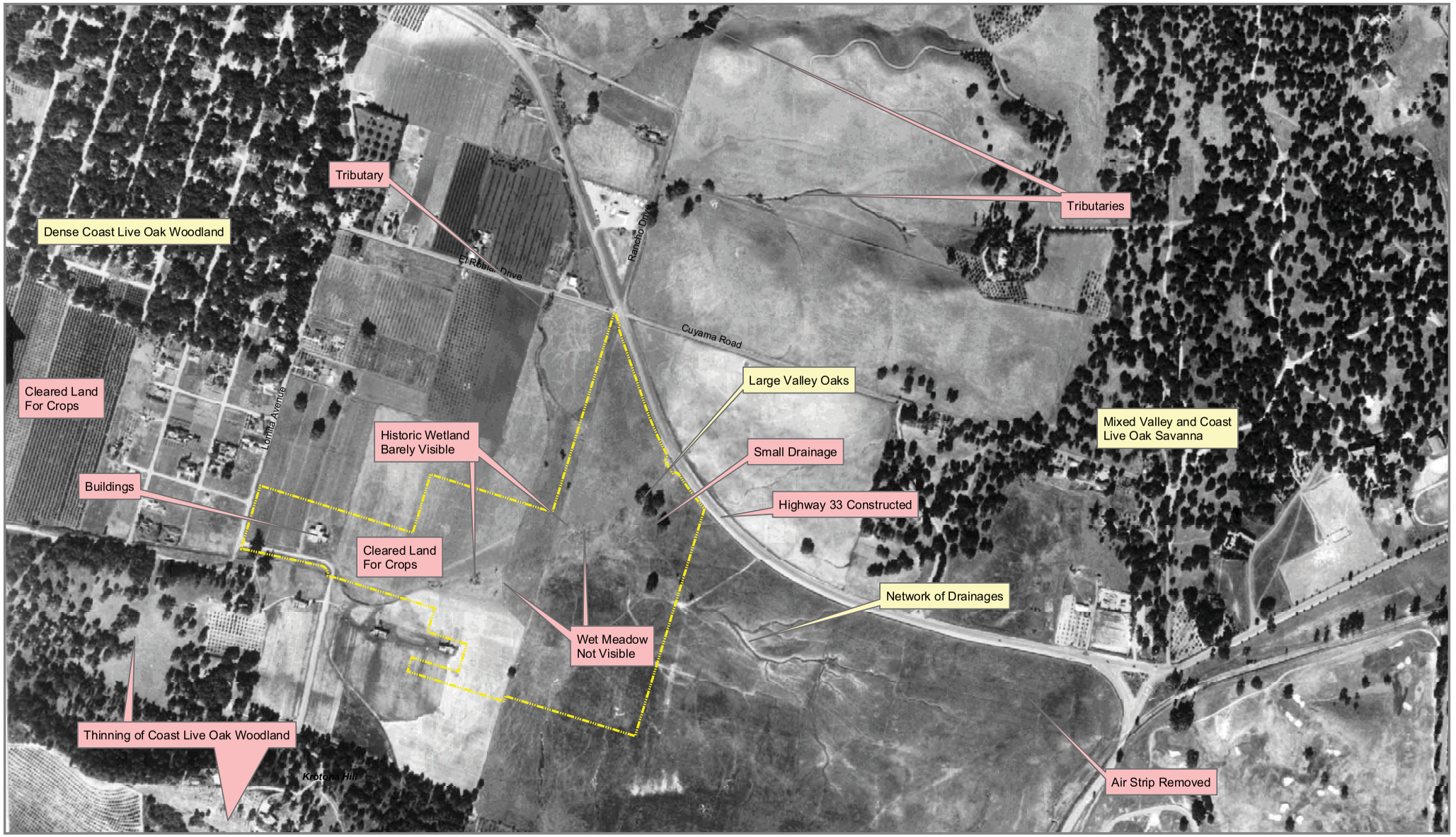
May 9, 1929 (Map 8)

Dense oak woodland covers large portions of the southern and western perimeters of the site, with transition zones marked by linear boundaries suggesting mechanical clearing of the site itself. Coastal Sage Scrub also appears to be present in association with the Coast Live Oaks, especially to the southeast. Today, native oaks still standing in these areas are primarily Coast Live Oak (*Quercus agrifolia*).

- Most of the property appears to have been mechanically cleared of native vegetation by 1929.
- A large crescent-shaped wetland covers the upper central portion of the site in the general vicinity of the Nordhoff drain and Happy Valley drain. See above text for description of water sources from surrounding tributaries.
- A swath of oak woodland to the east is also indicated, with a few oaks surrounding a small drainage leading to a wetland on the site. Some of these Valley Oaks (*Quercus lobata*) are still standing.
- An air strip is on the east side of the photograph.
- A fine network of drainages flow into the property from the east.

November 9, 1945 (Map 9)

- Highway 33, constructed in 1933, is clearly visible.
- The air strip is gone.
- Further thinning and clearing of oaks in the surrounding area is evident.
- Portions of the property appear plowed for crops, and most of it looks mechanically cleared.
- A building (farmhouse?) is visible on the western 'panhandle' (Besant Meadows property).
- The large wetland is gone but tributaries are discernible.
- The Valley Oaks are still standing, as are drainages originating from the future Nordhoff High School site.



Ojai Meadows Preserve Boundary

Data Sources:
UCSB Map and Imagery Lab: November 9, 1945 Aerial Photo
(Mark Hurd Aerial Surveys (C-9800))

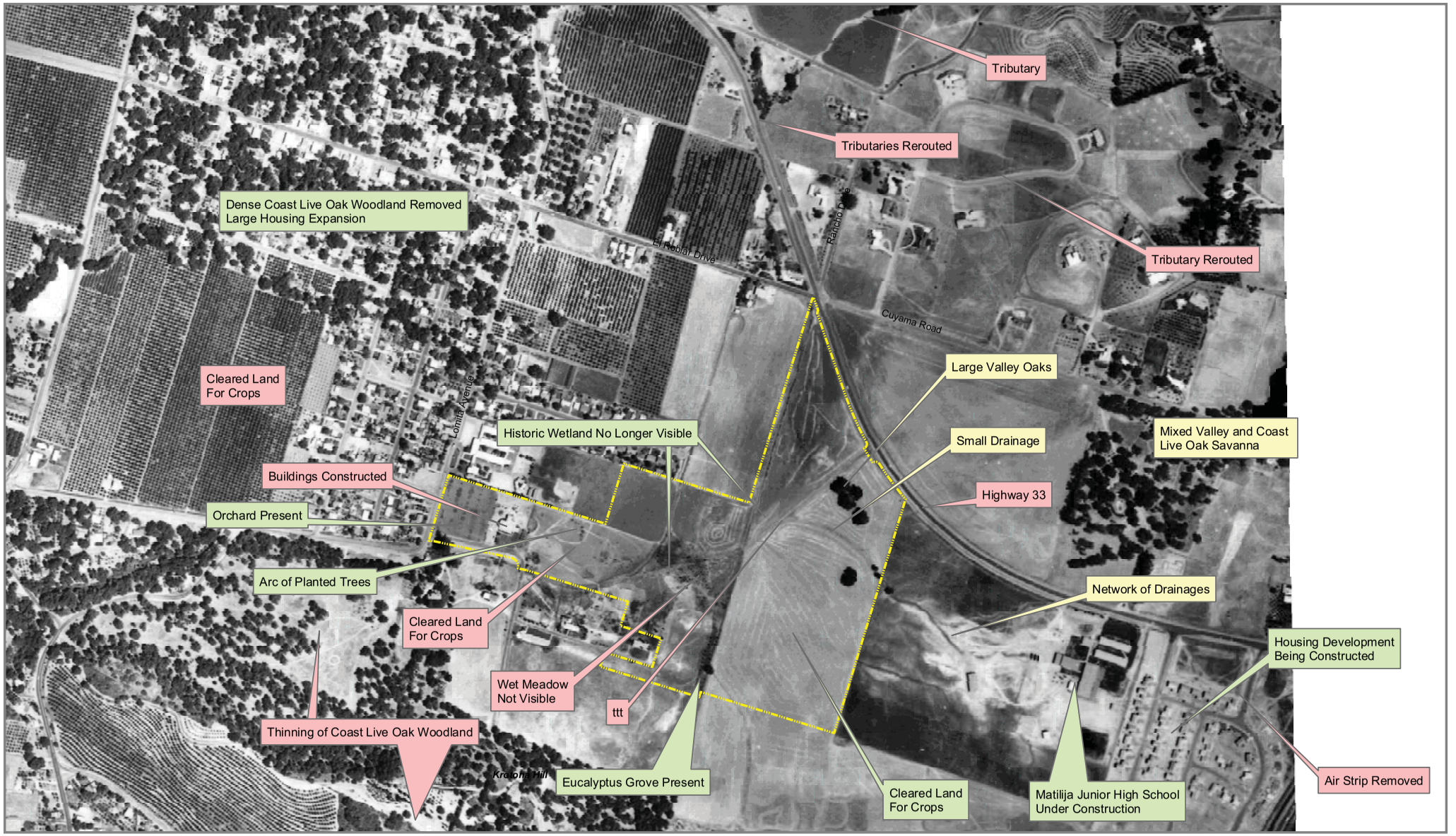
1945 Aerial Photograph

Condor Environmental Planning Services, Inc.
Tel: (805) 655-9139 - www.condorenvironmental.com

0 500 1,000 2,000 Feet

Ojai Meadows Preserve
Ojai Valley Land Conservancy

Map: 9
May 2004



Ojai Meadows Preserve Boundary

Data Sources:
UCSB Map and Imagery Lab: 1959 Aerial Photo
(Mark Hurd Aerial Survey (AXI-1959))

1959 Aerial Photograph

Condor Environmental Planning Services, Inc.
Tel: (805) 955-9139 - www.condorenvironmental.com

0 487.5 975 1,950 Feet

N

Ojai Meadows Preserve
Ojai Valley Land Conservancy

Map: 10
May 2004

1959 (Map 10)

- Construction of Matilija Junior High School has begun on the eastern side of the property.
- The Eucalyptus Grove is visible as small saplings in the center of the property.
- The property is being used for crops, evidenced by the plow lines visible in the photo.
- On the western corner of the property an orchard is visible, in addition to an 'arc' of trees planted to the east of the orchard.
- The upper reaches of the southern tributary, northwest of the property, is not as visible.
- The housing community to the southeast of the property is being developed.

1963 (Map 11)

- A defined channel is visible in the current location of the Happy Valley Drain, however, drain construction did not begin until 1964, and the portion on the property was not constructed until 1987-1988.
- The southern tributary to the northeast of the property has been replaced with a housing development.

January 30, 1969 (Map 12)

- A winter storm dropped over 3 inches of rain on January 19, 1969 (nwsla.noaa). More heavy rain fell on January 25. Note the large bodies of water draining from the eastern side of the property and north of the *Eucalyptus* grove.
- Happy Valley School and Happy Valley Drain are clearly noticeable. A ditch traversing the *Eucalyptus* grove in the vicinity of the Nordhoff drain (Besant Meadows) can be seen.
- Nordhoff High School as well as expanded buildings in the 'panhandle' area are visible. Altered drainage patterns are detectable along the high school boundary.
- Rectangular structure is located on Besant Meadows property south of Happy Valley drain.
- Dramatic housing expansion to the northwest, along with many orchards.
- Large Valley Oaks present.
- Young *Eucalyptus* grove present.

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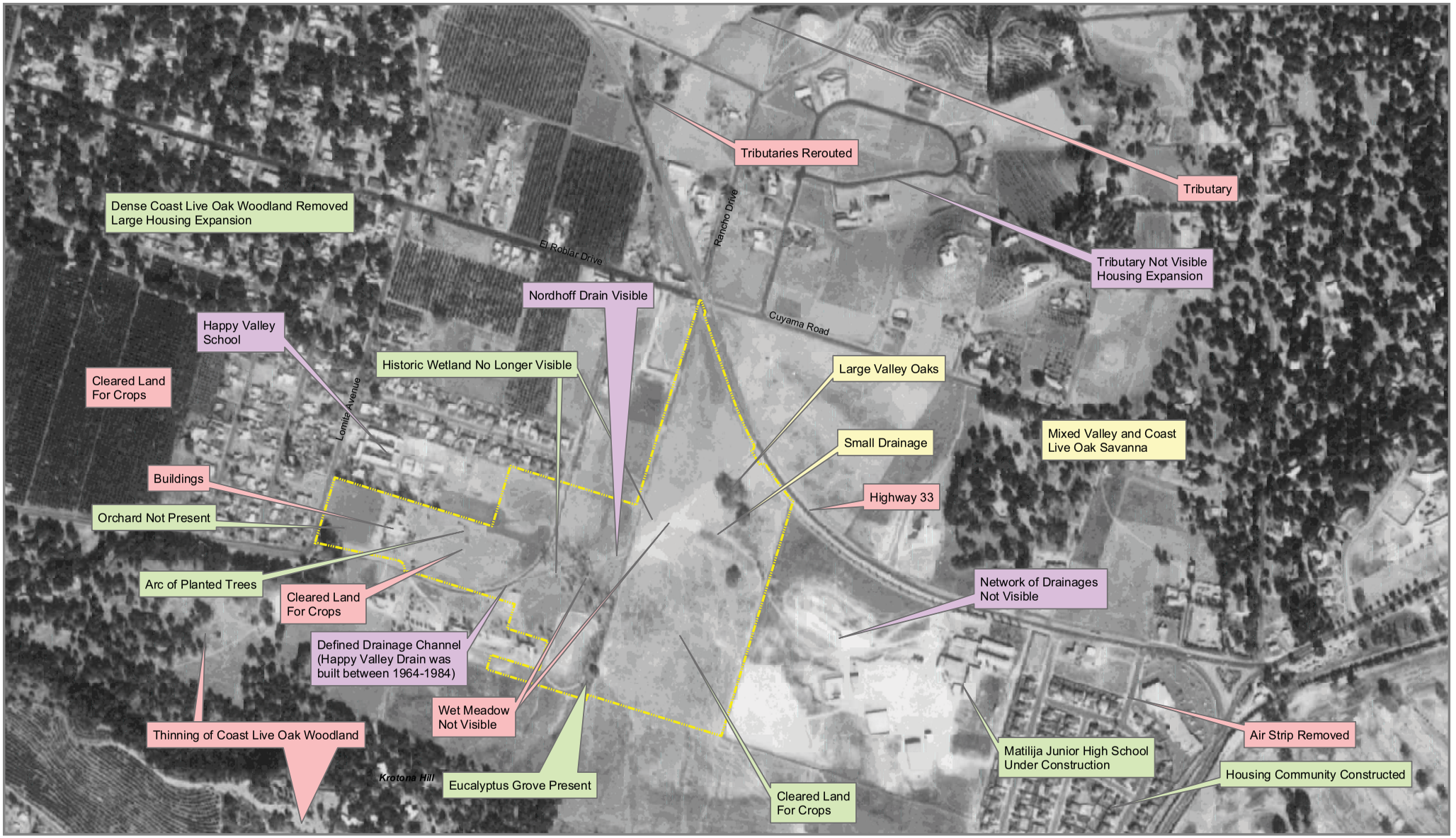


Ojai Meadows Preserve Boundary

Data Sources:
UCSB Map and Imagery Lab: 1963 Aerial Photo
(Mark Hurd Aerial Surveys (HA-RR))

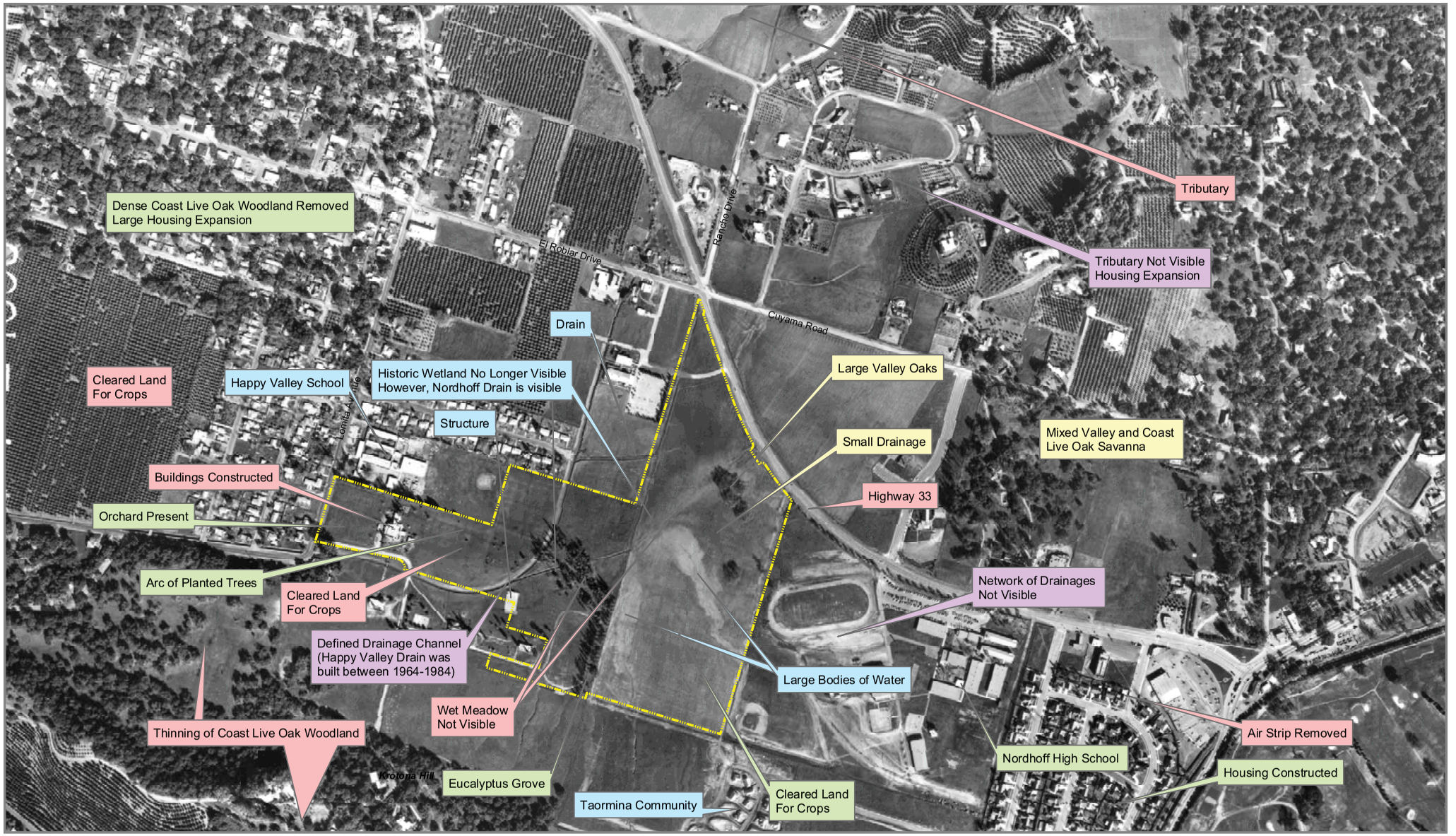
1963 Aerial Photograph

Condor Environmental Planning Services, Inc.
Tel: (805) 965-9139 - www.condorenvironmental.com

0 500 1,000 2,000 Feet

Ojai Meadows Preserve
Ojai Valley Land Conservancy

Map: 11
May 2004



Ojai Meadows Preserve Boundary

Data Sources:
UCSB Map and Imagery Lab: January 30, 1969 Aerial Photo
(Mark Hurd Aerial Surveys (HB-NQ))

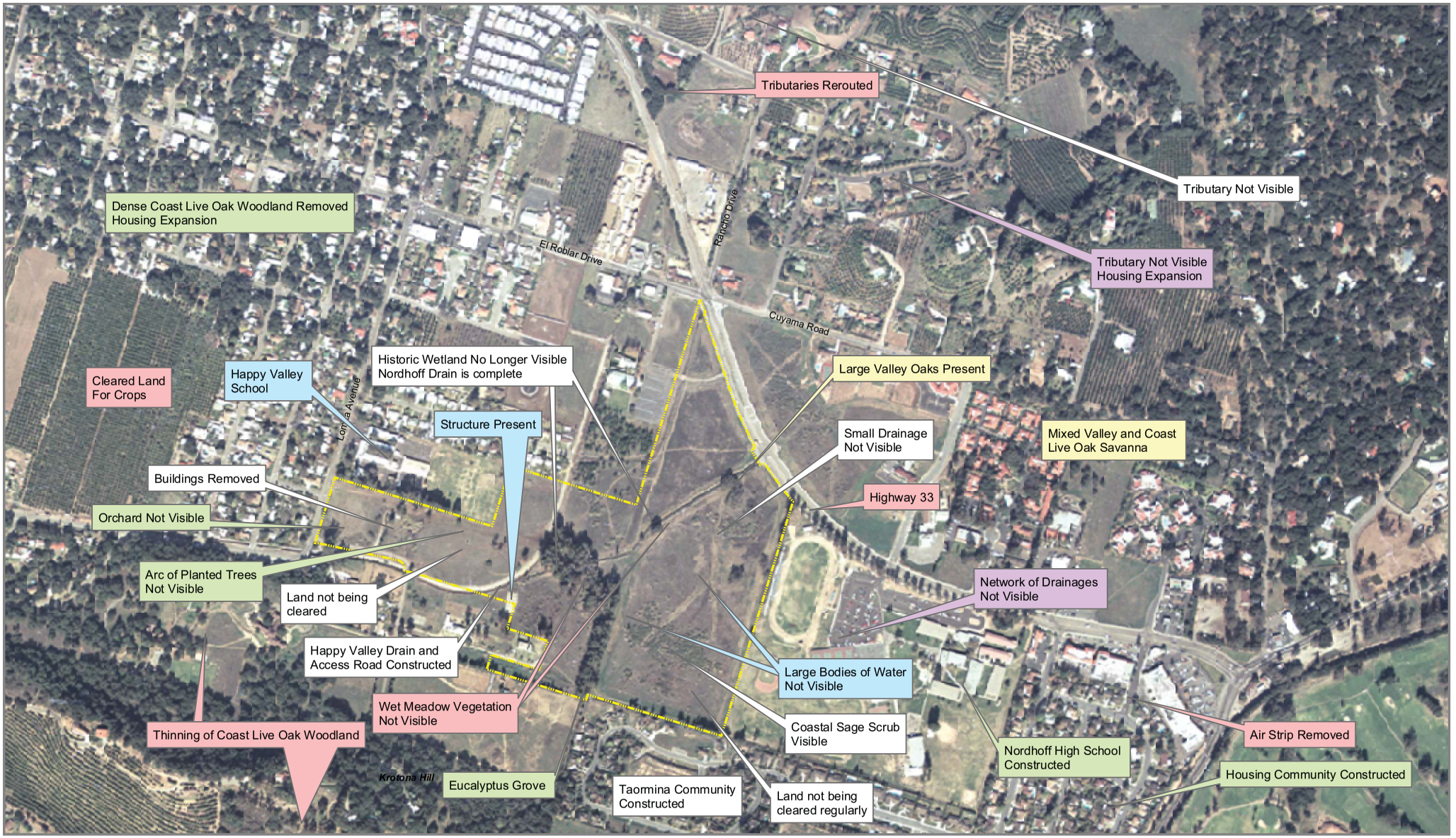
1969 Aerial Photograph

Condor Environmental Planning Services, Inc.
Tel: (805) 965-9139 - www.condorenvironmental.com

0 495 990 1,980 Feet

Ojai Meadows Preserve
Ojai Valley Land Conservancy

Map: 12
May 2004



Ojai Meadows Preserve Boundary

Data Sources:
UCSB Map and Imagery Lab: 1986 Aerial Photo
(Pacific Western (PW-VEN5))

1986 Aerial Photograph

Condor Environmental Planning Services, Inc.
Tel: (805) 965-9139 - www.condorenvironmental.com

0 500 1,000 2,000 Feet

Ojai Meadows Preserve
Ojai Valley Land Conservancy

Map: 13
May 2004

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August 24, 1978 (Not Mapped)

- Happy Valley Drain and Nordhoff drain visible. Little woody vegetation found along either corridor.
- Buildings on Besant Meadows properties have been removed.
- *Eucalyptus* grove has enlarged.
- More housing built to the northeast and southeast, with fewer oaks and orchards.
- Drainage patterns entering Ojai Meadows Preserve completely altered.
- Large Valley Oaks present.

October, 12, 1986 (Map 13)

- Nordhoff Drain has been completed crossing the property from Highway 33 to Happy Valley Drain.
- Coastal Sage Scrub vegetation is visible on the southeast portion, around the Valley Oaks near Nordhoff Drain and south of Saint Thomas Aquinas Church. This vegetation may have been able to recolonize the site in the absence of plowing or discing.
- The buildings on the west of Happy Valley Drain have been removed.

(3) The Way It Might Have Looked

Prior to 1800, the Ojai Meadows Preserve site was probably dominated by a coast live oak forest in the southwestern portion. A large freshwater marsh probably covered close to 5 acres of land in the middle of the site and additional wet meadow was probably also present along its margins. Valley Oak Savanna probably predominated on the eastern side of the property. This savanna may have been much more dense in terms of the number of mature trees than we are accustomed to seeing today. Between the giant Valley Oaks would have been a diverse array of native grasses and wildflowers in spring of most years. Small amounts of scattered coastal sage scrub may have also been present.

The wildlife component of the Ojai Meadows Preserve has probably changed dramatically since the arrival of Europeans in the late 1700s. At the top of the food chain, grizzly bears roamed freely, harvesting acorns in the fall and preying on smaller animals such as gophers and squirrels in the dry season, and perhaps small birds and other animals in the wetland. Native ungulates including antelope and deer (and possibly tule elk?), probably moved through the Preserve grazing on grasses that stayed green longer due to the presence of water most years compared to the surrounding drier grasslands. The ponded water on the site would have been suitable for red-legged frogs if the water regularly remained for three months or more, and if there was shade for them to hide from predators. Aquatic birds such as water fowl were probably plentiful during the winter months when ponding occurred.

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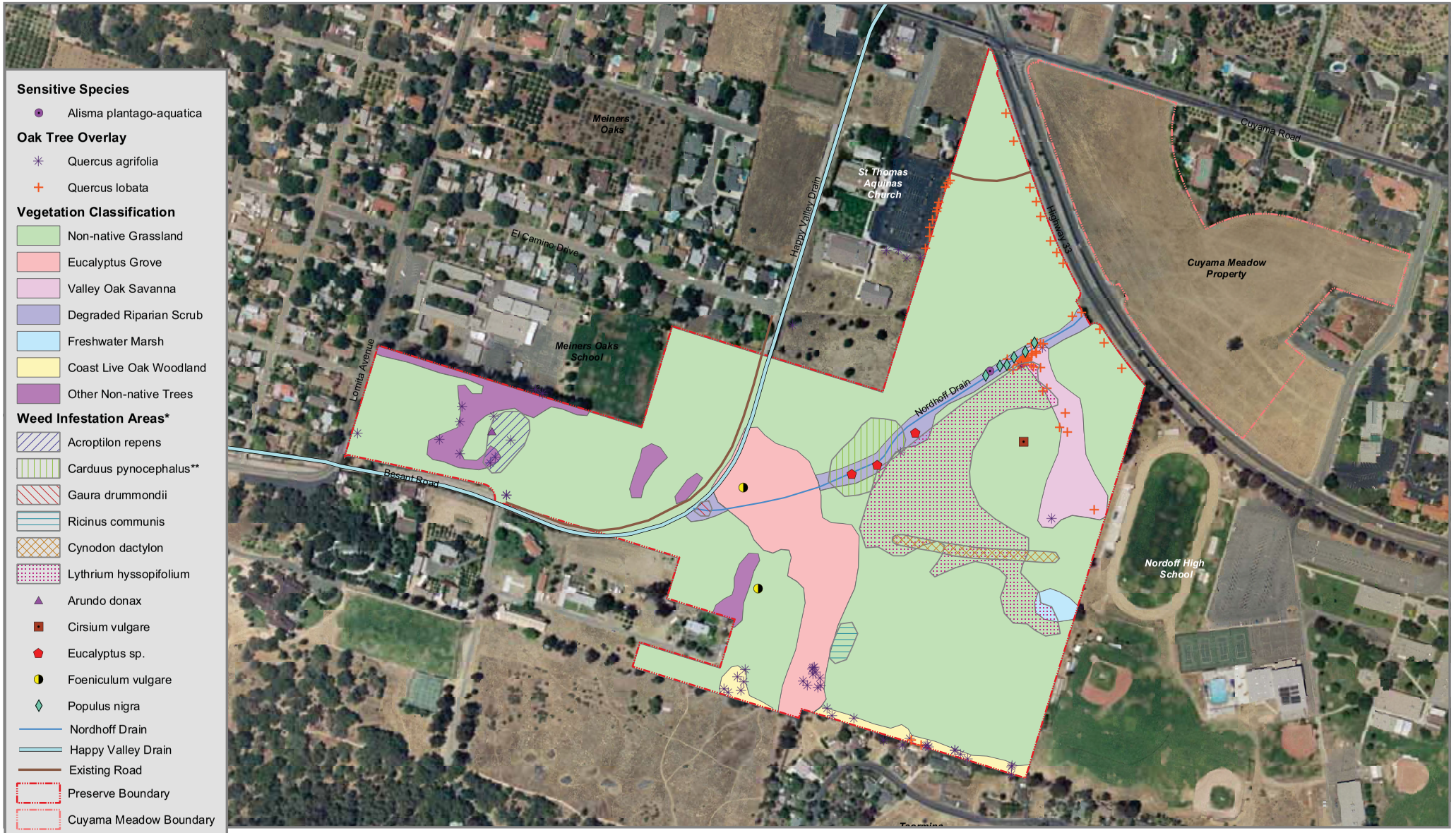

Sensitive Species

- Alisma plantago-aquatica

Oak Tree Overlay

- Quercus agrifolia
- Quercus lobata

Vegetation Classification

- Non-native Grassland
- Eucalyptus Grove
- Valley Oak Savanna
- Degraded Riparian Scrub
- Freshwater Marsh
- Coast Live Oak Woodland
- Other Non-native Trees

Weed Infestation Areas*

- Acroptilon repens
- Carduus pynocephalus**
- Gaura drummondii
- Ricinus communis
- Cynodon dactylon
- Lythrium hyssopifolium
- Arundo donax
- Cirsium vulgare
- Eucalyptus sp.
- Foeniculum vulgare
- Populus nigra
- Nordhoff Drain
- Happy Valley Drain
- Existing Road
- Preserve Boundary
- Cuyama Meadow Boundary

* Annual non-native grasses and mustards are widespread throughout the Preserve
** Carduus pynocephalus is scattered in other localities

Data Source:
AirPhoto USA: Aerial Photography (Date: Sept. 2002)

Existing Vegetation and Weed Infestation Areas

Condor Environmental Planning Services, Inc.
Tel: (805) 965-8139 · www.condorenvironmental.com

0 140 280 560 840 1,120 Feet

N

Ojai Meadows Preserve
Ojai Valley Land Conservancy

Map: 14
May 2004

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2. Ojai Meadows Preserve Vegetation Today

A total of 6 native vegetation communities, along with non-native woody plantings and weedy species can be found on Ojai Meadows Preserve site. Plant communities include Valley Oak Savanna, Coast Live Oak Woodland, non-native grassland, freshwater marsh, wet meadow and riparian woodland (Map 14). The largest non-native planting is a Eucalyptus grove that bisects the property. More than 140 species of plants are found at the Preserve, with about forty-five species of native plants and over 95 species of non-natives.

Community and species information was obtained first-hand during seven field surveys by Condor Environmental between September 2003 and March 2004, unless otherwise indicated. Previous work by Jacqueline Bowland and Associates (May 15, 1996) and students from the Donald Bren School for Environmental Science and Management at UCSB (summer 2000, Dunbar et al. 2001) included species lists for the site. Although these lists were consulted by Condor biologists, we elected to only include species we could document from the Preserve first-hand or that were documented for the site by David Magney, who is currently writing a flora for Ventura County. We found many of the same plants at the Preserve as previous researchers, along with several new ones that were previously unrecorded. In addition, careful examination of specimens resulted in assigning several plants to a different species than indicated by previous researchers. Because of the timing of this project (late summer, fall, and early winter 2003-2004), many annual plants were identified from dried remains and species most visible during other seasons (late winter, spring and early summer) are not recorded, but may be added later. It is recommended that a spring and early summer survey be included in restoration monitoring.

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Map 14

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a) Vegetation Communities at Ojai Meadows Preserve

(1) Non-native Grassland (Valley Grassland, California annual grassland series)

Historic aerial photographs reveal that the majority of the Ojai Meadows Preserve has been repeatedly cleared of native vegetation in the past. The Preserve was disked annually for decades (Magney 1988), which cleared the land of the perennial native vegetation that would have been present under undisturbed conditions. Today, non-native grassland covers the majority of the Preserve (46.6 acres, as shown in Map 14), although exotic grass species composition varies from place to place. The largest grassland component consists of introduced annual grasses growing in sandy loam soils, such as Slender Wild Oats (*Avena barbata*), Common Wild Oats (*Avena fatua*), Rip-gut Brome (*Bromus diandrus*), Soft Chess (*Bromus hordeaceus*), Red Brome (*Bromus madritensis* subsp. *rubens*), Foxtail Barley (*Hordeum murinum*), and annual Fescues (*Vulpia* species). Associated with these grasses are weedy mustards (*Brassica rapa, B. nigra,* and *Hirshfeldia incana*) and Filaree (*Erodium cicutarium, E. botrys*) along with patches of Common Vetch (*Vicia sativa*), Italian thistle (*Carduus pycnocephalus*), Milk Thistle (*Silybum marianum*), and others. Only a few natives are present in these grassland areas, such as Bicolored Lupine (*Lupinus bicolor*), Red Maids (*Calandrinia ciliata*), Canchalagua (*Centaurium venustum*) and Doveweed (*Eremocarpus setigerus*).

Photo 38: Non-native Grasses and Mustards, with view of Eucalyptus Windrow by Meiners Oaks Elementary School *photograph by Mary Carroll*

In moister soils near the southern edge of the Nordhoff drain, Annual Ryegrass (*Lolium multiflorum*) forms the dominant cover. To the north, Canary grass (*Phalaris minor*) is abundant, and the area west of Happy Valley drain is covered with Hood Canary Grass (*Phalaris paradoxa*). Bristly Ox-tongue (*Picris echioides*), Curly Dock (*Rumex crispus*), Hyssop Loosestrife (*Lythrum hyssopifolium*) and Castor Bean (*Ricinus communis*) are scattered in moister soil. Near Meiner Oaks Elementary School is a large patch of the invasive Russian Knapweed (*Acroptilon repens*). None of these are native to California.

One spreading native perennial grass may be present on the site in moist soils near the Nordhoff Drain: Meadow Barley (*Hordeum brachyantherum* subsp. *brachyantherum*). We will examine it later in

spring to confirm identification. Other native grasses on the site have been eliminated. Scattered native species in moister grassland soils include the perennial Narrowleaf Milkweed (*Asclepias fascicularis*), a major food source for wintering Monarch butterflies, and Alkali Mallow (*Malvella leprosa*), which is only known from four other sites in Ventura County (David Magney, *pers. comm.*); spring annuals Owl's-clover (*Castilleja densiflora*) and Bicolored Lupine (*Lupinus bicolor*); and summer annuals, Heermann's Tarweed (*Holocarpha heermannii*) and Turpentine Weed (*Trichostemma lanceolatum*), known only from seven other sites in Ventura County (David Magney, *pers. comm.*).

(2) Valley Oak Savanna (Valley Oak series)

It is likely that a mixed woodland of Valley and Coast Live Oaks were both found on the Preserve prior to 1800, with more Coast Live Oak Woodland on the southern end of the property near Krotona Hill in the sandy loam soils (see next section) and Valley Oak Savanna or mixed oak woodland on the northern end of the property. The 1929 aerial photograph of the site (Figure xxx) reveals Valley Oaks on either side of a small seasonal drainage to the east of the large wetland, a distribution near water courses that is typical of the species.

Photo 39: Valley Oaks in Winter on the Ojai Meadows Preserve *photograph by Mary Carroll*

The "forests" of majestic oaks from the Ojai Valley area have gradually given way to scattered trees in many areas. Only a few large Valley Oaks are present on the Ojai Meadows Preserve today, all of them east of the Nordhoff Drain (and historic wetland) on the northwest end of the property. At some point after the 1969 floods, a berm was installed to the east of the *Eucalyptus* grove and along the eastern edge of the Nordhoff drain, perhaps for flood control purposes (Belknap 2004). One of the unfortunate consequences of the construction of this berm was that it altered drainage patterns around the large Valley Oaks and may have created a situation in which water pooled, rather than drained away.

Although Valley Oaks require a high water table in order to thrive, all California oak species are subject to rot when exposed to standing water around their roots for any prolonged period of time (Mathews 1979). Photographs taken in 1995 of

Photo 40: Valley Oaks in 1995 on the Ojai Meadows Preserve *photograph by Richard Handley*

The GPS positions of some of these oaks match the large Valley Oaks visible in the historic aerial photographs from 1929, 1945, 1969, and 1978, in which they appeared to be healthy. In 1929, these oaks were visible on either side of a small drainage feeding into the large wetland.

Large fungi were observed growing from the trunk of one of the largest surviving oaks during tree surveys for this report (Photo 43). The fungus was identified by Dr. Robert Cummings, mycologist (*pers. comm.*), as *Ganoderma applanatum*, which causes heart rot. He reports:

> "The cavity at the base confirms heart rot, and I guarantee when it falls (which it surely will, sooner rather than later, once you see the mushrooms) you will see a hollow trunk. The berm could have [caused flooding that] killed the roots and weakened the tree and allowed the fungus to attack initially, or perhaps it finished the job quickly if it was already present."

a large Valley Oak adjacent to the Nordhoff Drain and berm also reveal standing water close to the trunk. Today this oak is dead.

Seven large *Quercus lobata* between 30 and 45 feet tall are present in this vicinity, with trunk diameters ranging from 11 to 16 inches. Two of the seven are dead, and two more have dropped major limbs and foliage and appear to be dying.

Photo 41: Dead Valley Oak in 2004 *photograph by Mary Carroll*

Photo 42: Valley Oak with Heart Rot on Ojai Meadows Preserve *photograph by Mary Carroll*

Photo 43: Fungus at Base of Valley Oak in Photo 42 *photograph by Mary Carroll*

Unlike most Valley Oak habitats in California, however, there are many young Valley Oak trees on the Ojai Meadows Preserve, most of which are located up on a berm near the Nordhoff Drain where drainage is better during flooded conditions than a few feet lower where the large oaks are found. During a field census by Condor Environmental, over 130 young valley oak seedlings and saplings with trunk diameters at breast height of less than 4 inches were counted in this small area of the Preserve. Much has been written about the lack of seedling regeneration of Valley Oaks in California. The abundance of young trees in a small area on the Preserve site is heartening and will provide valuable clues for effective means of restoring Valley Oak Savanna.

Photo 44: Young Valley Oaks at Ojai Meadows Preserve *photograph by Mary Carroll*

In addition, Valley Oaks were planted on the Preserve adjacent to Highway 33 and the St. Thomas Aquinas church property about ten years ago by Alasdair Coyne and a local Ojai environmental group called REAP, "Recycling and Environmental Action Program."

(3) Coast Live Oak Woodland (Southern Oak Woodland, Coast Live Oak series)

In the vicinity of the Ojai Meadows Preserve, historic aerial photographs reveal dense stands of Coast Live Oak Woodland to the south of the property (Krotona Hill and adjacent area) and also northwest of the property in Meiners Oaks where streets have been laid out by the time of the 1929 aerial photograph. In subsequent years this area is gradually filled with houses, surrounded by remaining Coast Live Oak trees (see 1929, 1945, 1969, 1978, and current aerial photographs). (Today Meiners Oaks still retains many large Coast Live Oak trees, although the ornamental landscapes inhibit most oak reproduction or establishment of native understory species.)

Photo 45: Coast Live Oaks at Ojai Meadows Preserve *photograph by Mary Carroll*

Based on these historical photographs, Coast Live Oak Woodland was probably abundant on the southern portion of the Ojai Meadows Preserve prior to European contact, and was probably scattered throughout the site, intergrading with Valley Oak Savanna towards the north end of the property. Indeed, the linear boundaries of Oak Woodland to the south and west of the property in the 1929 aerial photograph strongly suggest mechanical clearing. There is currently no habitat that would be considered pristine Coast Live Oak Woodland on the Preserve, and only scattered small to medium-sized Coast Live Oak trees are present.

Photo 46: Coast Live Oak Sapling Under Elm Canopy at Ojai Meadows Preserve *photograph by Mary Carroll*

There are two Coast Live Oak trees (*Quercus agrifolia*) on the Preserve near Lomita Avenue with trunk diameters at breast height of greater than 8 inches, the largest on the site. Many Coast Live Oak seedlings have become established through the years, often under the canopy of planted trees and shrubs, including *Eucalyptus*, elm (*Ulmus* species), oleander (*Nerium oleander*) and others. Over 100 *Quercus agrifolia* seedlings, saplings, and trees were counted on site during our census. Of these, the vast majority (87) have trunk diameters at breast height of less than 5 inches, and another twelve have diameters between 6 and 10 inches.

Associated with the young Coast Live Oaks are seedlings and saplings of Holly-leaf Cherry (*Prunus ilicifolia*). Both Coast Live Oak and Holly-leaf Cherry have fruits that are dispersed by birds, and the location of seedlings under trees of all types is probably not a coincidence; branches for perching and shade provide optimal conditions for oak and cherry seedling establishment (Carroll et al. 2004). Furthermore, the annual disking of the site probably removed woody seedlings growing in the open away from shrub and tree drip lines (Magney 1988, Magney 2001). Another bird-dispersed shrub, Toyon (*Heteromeles arbutifolia*), is also found on site under the *Eucalyptus* canopy and is an associate of Coast Live Oak Woodland. Other native understory species are largely absent, probably due to repeated clearing. Instead, the "understory" of the oaks consists of non-native weedy annual grasses and forbs.

Photo 47: Toyon Under Eucalyptus Canopy at Ojai Meadows Preserve *photograph by Mary Carroll*

(4) Freshwater Wetlands

There are currently four point sources of water into the Preserve: the Nordhoff Drain, which drains the Cuyama Meadows property and environs; the Happy Valley Drain, which receives runoff from storm drains and an unnamed drainage to the northeast of the Preserve; runoff from the Taormina community, which enters the Preserve through a pipe at the southern end of the *Eucalyptus* grove, and runoff from Nordhoff High School, which enters the site from a pipe on the

east side of the property. Native and non-native wetland species have become established as a result at each of these point sources of water, and are described in more detail below.

Freshwater marsh vegetation is currently found in several locations on the Ojai Meadows Preserve property. A pipe originating on the Nordhoff High School grounds discharges runoff and waste-water onto the Preserve – in about the same place as a historic drainage visible in early aerial photographs. The water currently forms a small pool at the outlet, which can be filled with algae during the warm season; a few yards from the source, native marsh species such as Southern Cattail (*Typha domingensis*), Yellow Nutsedge (*Cyperus eragrostis*) and saplings of Red Willow (*Salix laevigata*) and Yellow Willow (*S. lucida* subsp. *lasiandra*) have become established, along with weedy species such as Loosestrife (*Lythrum hyssopifolium),* Rabbit's-foot Grass (*Polypogon monspeliensis)* and others.

Photo 48: Pipe from Nordhoff High School *photograph by Mary Carroll*

Photo 49: Wetland Plants and Eucalyptus Along Nordhoff Drain *photograph by Mary Carroll*

Both the Happy Valley Drain and Nordhoff Drain also support freshwater marsh vegetation, although different species are found in each drain. The Nordhoff Drain is the most diverse, with a clump of native Southern Cattail (*Typha domingensis*) near its junction with Highway 33, dense colonies of California Bulrush (*Scirpus californicus)* along the bottom of much of the drain in sunny locations, scattered Yellow Nutsedge (*Cyperus eragrostis*), a few Mexican Rush (*Juncus mexicanus*) along the banks in one location and other native and non-native species. There is one location containing the regionally rare Water-plantain (*Alisma plantago-aquatica*), which is only known from Mirror Lake in the Ojai Valley and Ventura County as a whole.

Happy Valley Drain, which is concrete-lined as it enters the property near St. Thomas Aquinas Church, has earthen sides and bottoms as it traverses the Ojai Meadows Preserve. It supports native Water-cress (*Rorippa nasturtium-aquatica*), Water Speedwell (*Veronica anagalis-aquatica*), Mexican Spangletop (*Leptochloa uninervia*) as well as several non-natives along the channel bottom. Where the Happy Valley Drain and Nordhoff Drains merge just northwest of the *Eucalyptus* grove, a few clumps of native wetland species that are found in marshes as well as wet meadows occur, including Mexican rush (*Juncus mexicanus*), Common Spikerush (*Eleocharis macrostachya*), and Yellow Nutsedge (*Cyperus eragrostis*).

These wetland plants manage to persist despite annual spraying at the behest of the Ventura County Watershed Protection District. The banks and bottom of the Happy Valley Drain are sprayed "as needed" with an herbicide, Aquamaster, a maximum of three times a year. Roundup is used near the service road and, if rainfall is greater than 2 inches before December 1 or after April 1, a pre-emergent herbicide, Diuron, is sprayed on top of the bank and inside slopes. Herbicides are applied by a licensed herbicide contractor and they document wind speed, drift and temperature conditions and follow guidelines (ie. no spraying above winds 5mph and before forecasted rain etc.) (John Lagomarsino, Ventura County Watershed Protection District *pers. comm*.).

Non-native plants such as Spearmint (*Mentha spicata*), Cutleaf Geranium (*Geranium dissectum*) and Sweet Alyssum (*Lobularia maritima*) have become established by the pipe entering the Preserve from the Taormina community, along with the native Yellow Nutsedge.

Small seasonal pools continue to form in non-native grassland at the Ojai Meadows Preserve east of Nordhoff Drain after winter rains (Photos 36 and 37).

(5) Riparian Woodland (Southern Willow Scrub and Southern Riparian Scrub)

Riparian Woodland, characterized by woody shrubs and trees, is most well developed along the Nordhoff Drain. A few Arroyo Willow (Salix lasiolepis) and Yellow Willow (*S. lucida* subsp. *lasiandra*) are scattered in this drainage, especially at its junction with Highway 33. Valley Oak (Quercus lobata) is found on the banks of this drainage in places, as are young Coast Live Oaks (*Quercus agrifolia*). A few cultivated Lombardy Poplars (*Populus nigra* 'Italica') and Fan Palms (*Washingtonia robusta*) are present on the eastern banks of Nordhoff Drain, and *Eucalyptus* are scattered in places along the channel outside the main grove.

Photo 50: Arroyo Willow and Other Wetland Plants at Confluence of Nordhoff and Happy Valley Drains *photograph by Mary Carroll*

(6) Eucalyptus Grove

The large **Eucalyptus Grove** on the southern end of the Preserve was planted in the 1950s by the gardener of Meiners Oaks Elementary School, Frank Noyes, and a group of students. According to Frank Noyes, approximately 30 species of Eucalyptus were originally planted (Magney *pers. comm.).* Among the Eucalyptus species in the main grove are Blue Gum Eucalyptus (*Eucalyptus globulus*), Red Gum Eucalyptus (*Eucalyptus camaldulensis*), Red Ironbark (*Eucalyptus sideroxylon),* and others. In addition, a few non-native Bailey's Acacia (*Acacia baileyana)* occur in this grove, along with native Coast Live Oak (*Quercus agrifolia*) and Toyon (*Heteromeles arbutifolia*), which have come up under the canopy of the *Eucalyptus* trees. In general, there is an absence of understory species in this grove, which is typical of *Eucalyptus* due to the allelopathic chemicals in its leaves, which inhibit germination of competing species.

These trees have become a roosting site for seven species of raptors, including Red-shouldered Hawk, Red-tailed Hawk, American Kestrel, Northern Harrier, Barn

Photo 51: Eucalyptus grove at the Preserve *photograph by Katrina Burton*

Owl, Great-horned Owl and White-tailed Kite (O'neill no date).

An additional line of Blue Gum (*Eucalyptus globulus*) was planted as a screen along the fence between the Preserve and the school, also in the 1950s.

(7) Non-native Woody Plantings

Photo 52: Non-native planted trees with line of Eucalyptus grove next to Meiners Oaks school *photograph by Elihu Gevirtz*

Other **Non-native Woody Plantings** associated with the Besant Meadows buildings include Oleander (*Nerium oleander*), Italian Cypress (*Cupressus sempervirens*), English Walnut (*Juglans regia*), Pomegranate (*Punica granatum*), Fire-thorn (*Pyracantha angustifolia*), cultivated Rose (*Rosa* cultivar), cultivated Hibiscus (*Hibiscus* cultivar) and two or three varieties of Elm (*Ulmus* species and/or cultivars). As mentioned above, many Coast Live Oak seedlings and saplings may be found under these plantings, along with Holly-leaved Cherry (*Prunus ilicifolia*). In addition there are scattered *Eucalyptus* in this area and a large *Melaleuca*, along with a few Bailey's Acacia (*Acacia baileyana*). Non-native plantings also occur near the property boundary between the Preserve and homes of the Taormina Community.

b) Plant Species at Ojai Meadow Preserve

(1) Plant Species List

Table 2
Plant species observed at Ojai Meadows Preserve by Condor Staff
(July 23, 2003 - March 1, 2004 - fall and winter only)

* = Non-native: *N = Noxious introduced weed
Additions provided generously by David Magney (DM)

Scientific Name	Common Name			Habit	Habitat
Acacia baileyana	Bailey's Acacia	*		Tree	among Coast Live Oak, Eucalyptus
Acroptilon repens	Russian Knapweed	* N		Herbaceous perennial	Grassland
Agave americana	Century Plant	*		Herbaceous perennial	Planted
Alisma plantago-aquatica	Water-plantain			Herbaceous perennial	Wetlands
Amaranthus albus	Pigweed Amaranth	*		Annual	Grassland
Anagallis arvensis	Scarlet Pimpernel	*		Annual	Grassland, wetlands
Arundo donax	Giant Reed	* N		Perennial grass	Wetlands
Asclepias fascicularis	Narrow-leaved Milkweed			Herbaceous perennial	Grassland
Avena barbata	Slender Wild Oats	*		Annual grass	Grassland
Avena fatua	Wild Oats	*		Annual grass	Grassland
Baccharis pilularis	Coyote Bush			Shrub	Grassland, Oak Woodland
Baccharis salicifolia	Mule Fat			Shrub	Riparian habitats
Brassica nigra	Black Mustard	* N		Annual	Grassland
Brassica rapa	Field Mustard	* N		Annual	Grassland
Bromus diandrus	Ripgut Brome	*		Annual grass	Grassland
Bromus hordeaceus	Soft Chess	*		Annual grass	Grassland
Bromus madritensis subsp. rubens	Red Brome	*		Annual grass	Grassland
Calandrinia ciliata	Red Maids			Annual	Grassland
Capsella bursa-pastoris	Shepherd's Purse	*		Annual	Grassland
Carduus pynocephalus	Italian Thistle	* N		Annual	Grassland
Castilleja densiflora	Owl's Clover			Annual	Grassland
Centaurea solstitialis	Yellow Star-thistle	* N		Annual	Grassland
Centaurium venustum	Canchalagua		DM	Annual	Grassland
Cerastium glomeratum	Mouse-eared Chickweed	*		Annual	Woodland
Chamaesyce serpyllifolia	Thyme-leaved Spurge			Annual	Grassland
Cichorium intybus	Chicory	*		Annual	Grassland
Cirsium vulgare	Bull Thistle	* N		Annual	Grassland

Scientific Name	Common Name			Habit	Habitat
Conium maculatum	Poison-hemlock	*		Annual	Grassland
Convolvulus arvensis	Bindweed	*		Herbaceous perennial	Grassland
Conyza bonariensis	Flax-leaved Fleabane	*		Annual	Grassland
Conyza canadensis	Horseweed	*		Annual	Grassland
Cupressus sempervirens	Italian Cypress	*		Tree	Planted
Cynodon dactylon	Bermuda Grass	*N		Perennial grass	Grassland, wetlands
Cyperus eragrostis	Yellow Nutsedge			Perennial sedge	Wetlands
Daucus pusillus	Rattlesnake Weed		DM	Annual	Grassland
Echinochloa crus-galli	Barnyard Millet	*		Annual grass	Grassland
Eichhornia crassipes	Water Hyacinth	* N	DM	Herbaceous perennial	Wetlands
Eleocharis macrostachya	Common Spikerush			Perennial rush	Wetlands
Eremocarpus setigerus	Doveweed			Annual	Grassland
Erodium botrys	Broad-leaved Filaree	*		Annual	Grassland
Erodium cicutarium	Redstem Filaree	*		Annual	Grassland
Erodium moschatum	Whitestem Filaree	*		Annual	Grassland
Eucalyptus camaldulensis	Red Gum Eucalyptus	*		Tree	Planted
Eucalyptus globulus	Blue Gum Eucalyptus	* N		Tree	Planted
Eucalyptus polyanthemos	Silver Dollar Gum	*		Tree	Planted
Eucalyptus sideroxylon	Red Ironbark	*		Tree	Planted
Euphorbia peplus	Petty Spurge	*		Annual	Shaded area by Taorimina drain
Foeniculum vulgare	Fennel, Sweet Anise	* N		Herbaceous perennial	Grassland
Gaura drummondii	Drummond's Gaura	* N		Herbaceous perennial	Grassland, bank of HV Drain
Geranium dissectum	Cut-leaf Geranium	*		Annual	Moist disturbed site
Gnaphalium californicum	Green Everlasting			Herbaceous perennial	Grassland
Heteromeles arbutifolia	Toyon, Christmas Berry			Shrub	Woodland
Heterotheca grandiflora	Telegraph Weed			Annual	Grassland
Hirshfeldia incana	Summer Mustard	*		Annual	Grassland
Holocarpha heermannii	Heermann's Tarweed			Annual	Grassland
Hordeum brachyantherum subsp. brachyantherum	Meadow Barley			Perennial grass	Wetlands
Hordeum marinum	Mediterranean Barley	*		Annual grass	Grassland
Hordeum murinum	Foxtail	*		Annual grass	Grassland
Hypochaeris glabra	Smooth Cat's Ears	*		Annual	Grassland
Juglans regia	English Walnut	*		Tree	Planted
Juncus bufonius	Toad Rush		DM	Annual	Wetlands
Juncus mexicanus	Mexican Rush			Perennial rush	Wetlands
Juncus phaeocephalus	Brown-headed Rush			Perennial	Wetlands

Scientific Name	Common Name			Habit	Habitat
				rush	
Kickxia elatine	Kickxia	*		Herbaceous perennial	Grassland
Lactuca serriola	Prickly Lettuce	*		Annual	Grassland
Lavatera cretica	Cornish Mallow	*		Herbaceous perennial	Grassland
Leptochloa uninervia	Mexican Spangletop			Annual grass	Wetlands
Lobularia maritima	Sweet Alyssum	*		Herbaceous perennial	Woodland, Wetlands
Lolium multiflorum	Mediterranean Rye	*		Annual grass	Grassland
Lonicera japonica	Japanese Honeysuckle	*		Herbaceous perennial	Planted
Lotus purshianus	Spanish Clover	*		Herbaceous perennial	Wetlands
Lupinus bicolor	Bicolored Lupine			Annual	Valley Grassland
Lupinus succulentus	Succulent Lupine			Annual	Valley Grassland
Lythrum hyssopifolium	Hyssop Loosestrife	*		Annual, herbaceous perennial	Wetlands
Malva parviflora	Cheeseweed	*		Annual	Grassland
Malvella leprosa	Alkali Mallow			Herbaceous perennial	Wetlands
Marrubium vulgare	Horehound	*		Subshrub, herbaceous perennial	Grassland, woodland
Medicago polymorpha	Bur-clover	*		Annual	Grassland
Medicago sativa	Alfalfa	*	DM	Annual	Grassland
Melaleuca armillaris	Bracelet Honey Myrtle	*		Tree	Planted
Melilotus indica	Yellow sweet-clover	*		Annual	Wetlands, grassland
Mentha spicata	Spearmint	*		Herbaceous perennial	Wetlands
Nerium oleander	Oleander	*		Shrub	Planted
Oxalis corniculatus	Creeping Wood-sorrel	*		Herbaceous perennial	Grassland
Oxalis pes-caprae	Bermuda-Buttercup	*		Herbaceous perennial	Grassland, woodland
Paspalum dilitatum	Dallis Grass	*		Perennial grass	Wetlands
Pennisetum clandestinum	Kikuyu Grass	* N		Perennial grass	Wetlands
Phalaris aquatica	Harding grass	*		Perennial grass	Grassland
Phalaris minor	Littleseed Canary-grass	*		Annual grass	Grassland
Phalaris paradoxa	Hood Canary-grass	*		Annual grass	Wetlands
Picris echioides	Bristly Ox-tongue	* N		Annual/biennial	Grassland
Pinus halapensis	Aleppo Pine	*		Tree	Planted
Piptatherum miliaceum	Smilo	*		Perennial grass	Grassland

Scientific Name	Common Name			Habit	Habitat
Plantago lanceolata	English Plantain	*		Herbaceous perennial	Wetlands, grassland
Polygonum arenastrum	Knotweed	*		Annual	Grassland, wetlands
Polypogon interruptus	Ditch Beardgrass	*		Annual	Wetlands
Polypogon monspeliensis	Rabbit's foot grass	*		Annual	Wetlands
Populus nigra	Lombardy Poplar	*		Tree	Planted
Portulaca olearacea	Common Purslane	*		Annual	Wetlands
Prunus ilicifolia	Holly-leaf Cherry			Shrub	Oak Woodland
Punica granatum	Pomegranate	*		Shrub	Planted
Pyracantha angustifolia	Fire thorn	*		Shrub	Planted
Quercus agrifolia	Coast Live Oak			Tree	Oak Woodland
Quercus lobata	Valley Oak			Tree	Valley Oak Savanna
Raphanus sativus	Wild Radish	*		Annual	Grassland
Rhamnus ilicifolia	Holly-leaf Coffeeberry			Shrub	Woodland
Ricinus communis	Castor-bean	*		Herbaceous perennial	Grassland
Rorippa nasturtium-aquatica	Water-cress			Herbaceous perennial	Wetlands
Rosa cultivar	Rose	*		Shrub	Planted
Rubus ursinus	California Blackberry			Viny shrub	Oak Woodland, Riparian Woodland
Rumex crispus	Curly Dock	* N		Herbaceous perennial	Grassland, wetlands
Rumex salicifolius	Green Dock			Herbaceous perennial	Wetlands
Silene gallica	Windmill Pink	*		Annual	Grassland
Salix laevigata	Red Willow			Shrub/Tree	Riparian Woodland
Salix lasiolepis	Arroyo Willow			Shrub	Riparian Woodland
Salix lucida subsp. lasiandra	Yellow Willow			Shrub/Tree	Riparian Woodland
Sambucus mexicana	Mexican Elderberry			Shrub	Oak Woodland/ Riparian Woodland
Schinus mollis	Peruvian Pepper Tree	*		Shrub/Tree	Planted
Schinus terebinthifolius	Brazilian Pepper Tree	*		Shrub/Tree	Planted
Scirpus californicus	California Bulrush			Herbaceous perennial	Wetlands
Sidalcea malvaeflora subsp californicum	Checker-bloom		DM	Herbaceous perennial	collected in 1952
Silybum marianum	Milk Thistle	* N		Annual	Grassland
Solanum nigrum	Black Nightshade	*		Herbaceous perennial	Woodland
Sonchus asper	Prickly Sow-thistle	*		Annual	Grassland
Sonchus oleraceus	Common Sow-thistle	*		Annual	Grassland

Scientific Name	Common Name			Habit	Habitat
Sorghum halapense	Johnson Grass	*		Perennial grass	Grassland
Spergula arvensis	Starwort	*		Annual	Grassland
Torilis nodosa	Knotted Hedge Parsley	*		Annual	Grassland
Toxicodendron diversilobum	Poison-oak			Shrub	Woodland
Tribulus terrestris	Puncture Vine	*		Annual`	Grassland
Trichostema lanceolatum	Turpentine Weed			Annual	Grassland
Triticum aestivum	Cultivated Wheat	*		Annual	Grassland
Typha domingensis	Southern Cat-tail			Herbaceous perennial	Wetlands
Ulmus parvifolia	Chinese Elm	*		Tree	Planted
Ulmus pumila?	Elm	*		Tree	Planted
Veronica anagallis-aquatica	Water Speedwell			Riparian habitats	Wetlands
Vicia sativa	Common Vetch	*		Annual	Grassland
Vicia villosa	Winter Vetch	*		Annual	Grassland
Vulpia myuros	Rattail Fescue	*		Annual grass	Grassland
Vulpia octoflora	Six-weeks Fescue			Annual grass	Grassland
Washingtonia robusta	Fan Palm	*		Tree	Planted, some young
Xanthium strumarium	Cocklebur			Herbaceous perennial	Grassland

(2) Plant Species of Special Concern:

Six plant species of special concern are located within the Ojai and Matilija quadrangles, as listed by the California Department of Fish and Game Natural Diversity Data Base: Miles's Milk-vetch (*Astragalus didymocarpus* var. *milesianus*), Davidson's Saltscale (*Atriplex serenana* var. *davidsonii*), Late-flowered Mariposa Lily (*Calochortus weedii* var. *vestus*), Ojai Fritillary (*Fritillaria ojaiensis*), Sanford's Arrowhead (*Sagitarria sanfordii*), and Salt Spring Checkerbloom (*Sidalcea neomexicana*).

Miles' Milk-vetch was reported as found in the Ojai area in *A Flora of the Santa Barbara Region* (Smith 1998), but no documentation is known. Because it is occurs elsewhere on loamy soils and slopes in grassland, the Ojai Meadows Preserve is potential habitat for this rare variety.

Davidson's Saltscale was found along railroad tracks by San Antonio Road in 1971. It is unlikely that this species was on the Preserve at one time since it was only recorded once in the area. However, it is possible.

Late-flowered Mariposa Lily has been found at 1,400 feet on Black Mountain and at 1,800 feet along the Pratt Canyon Trail off of Nordhoff Ridge. It is extremely unlikely that this species was ever found at Ojai Meadows Preserve because habitat historically on the Preserve was not suitable for this species.

Ojai Fritillary has been reported from Gridley Canyon and Stewart Canyons draining the Nordhoff Ridge at 2,200 – 2,400 feet in chaparral. It is extremely unlikely that this species was ever found at Ojai Meadows Preserve because habitat historically on the Preserve was not suitable for this species.

Sanford's Arrowhead has only been reported from Mirror Lake in the Ojai area, and was last seen in 1983. It is possible that this species was found in the historic wetland on the Ojai Meadows Preserve, but no plant lists or collections were made from the area before the wetland was drained.

Salt Spring Checkerbloom was reported in 1962 between Santa Ana Boulevard and San Antonio Creek Bridge along the railroad tracks and has not been seen since. It is unlikely that this species was on the Preserve at one time since it was only recorded once in the area. However, it is possible.

Rare plants that are extremely uncommon in the Ojai Valley area that are found on Ojai Meadows Preserve include Water-plantain (*Alisma plantago-aquatica*), known only from Mirror Lake and Ojai Meadows Preserve; Alkali Mallow (*Malvella leprosa*), known from only four other occurrences in Ventura County; Vinegar Weed (*Trichostema lanceolatum*), known only from seven other occurrences in Ventura County.

The California Department of Fish and Game has designated four native communities found at the Ojai Meadows Preserve as sensitive habitat: Coastal and Valley Freshwater Marsh, Valley Oak Woodland, Southern Willow Scrub and Southern Riparian Scrub.

3. Wildlife

A wide variety of common reptiles and amphibians are expected to occur on the Preserve, with western toads, Pacific treefrogs and western fence lizards observed during the field survey. Other species likely to be found on the property include; arboreal salamander, California slender salamander, western skink, California alligator lizard, common kingsnake, and gopher snake.

No sensitive species (i.e. California red-legged frogs *Rana aurora* and two-striped garter snake *Thamnophis hammondii*) were found during the field surveys and are not expected to occur on the property. These species are much more aquatic and the property does not support the aquatic habitat they require. Red-legged frogs are known to occur in San Antonio Creek a little less than one mile to the south of the property and they are known to move several miles overland to reach suitable habitat. However, the rugged terrain and rural development

between the creek and the Preserve is expected to prevent frogs from migrating to the site.

A wide variety of common birds were observed during the brief field survey, and additional species that were not documented are nonetheless expected to utilize the Preserve. A number of species have been recorded as nesting within the Preserve and raptor nest material was observed within the eucalyptus grove, most likely red-tailed hawk or red-shouldered hawk. Raptor nest sites have protective status and should be given consideration within the restoration plan. A Cooper's hawk has been observed on the property and is expected to utilize the area for foraging, habitat suitable for nesting is not found within the Preserve. Yellow warblers may move through the area but are also not expected to breed within the Preserve because of the lack of suitable habitat. No other sensitive birds are expected to utilize the property.

The following list of birds includes some of the species observed within the property by Vince Semonsen, Condor Senior Wildlife Biologist on a brief one day visit in Winter 2003/2004 supplemented by a list provided by the local Audubon Society (Dieges 2003). The species include: Cooper's hawk, red-tailed hawk, red-shouldered hawk, turkey vulture, American kestrel, California quail, killdeer, California gull, Western gull, rock dove, band-tailed pigeon, mourning dove, barn owl, great horned owl, white-throated swift, black-chinned hummingbird, Anna's hummingbird, Allen's hummingbird, acorn woodpecker Nuttall's woodpecker, downy woodpecker, northern flicker, Pacific-sloped flycatcher, black phoebe, Say's phoebe, Cassin's kingbird, western kingbird, loggerhead shrike, Hutton's vireo, Steller's jay, scrub jay, crow, raven, five species of swallow, Mountain chickadee, oak titmouse, white-breasted nuthatch, Bewick's wren, ruby-crowned kinglet, blue-gray gnatcatcher, western bluebird, hermit thrush, American robin, wrentit, mockingbird, California thrasher, starlings, common yellowthroat, yellow warbler, orange-crowned warbler, yellow-rumped warbler, spotted towhee California towhee, song sparrow, white-crowned sparrow, dark-eyed junco, red-winged blackbird, western meadowlark, brown-

Photo 53: Great Egret Stalking Breakfast on the Preserve, March 2004 *photograph by Mary Carroll*

headed cowbird, Bullock's oriole, house finch, lesser goldfinch, American goldfinch, house sparrow, great blue heron and great egret.

The only mammals seen during the survey were western ground squirrels and pocket gophers. Gopher sign was abundant, along with numerous small runways in the grass indicating a healthy mouse, vole and other small mammal population. Tracks and scat were noted for coyote, raccoon, possum and skunk; with bobcat and deer expected to frequent the area.

G. Water Quality

Plant establishment and growth, as well as wildlife use can be affected by the quality of water entering the Preserve. Some of the contaminants, such as phosphates and herbicides, in urban runoff water can be successfully eliminated by filtration, wetland design and vegetation (ie "bioswales"). However, it is imperative to the design and implementation of the plan to have an adequate understanding of the quality of water expected from surrounding lands.

Water quality sampling was conducted by Condor in winter 2004. Samples were collected from the four water input areas of the Preserve:

(1) Nordhoff High School at the inlet pipe
(2) Taormina housing community at the inlet pipe
(3) Happy Valley Drain as it enters the preserve
(4) Nordhoff Drain at Highway 33.

A brief discussion of the water quality at the Preserve is provided below. Appendix 1 contains the laboratory data sheets.

1. Results and Discussion

a) Coliform Bacteria

Results of the coliform tests are shown in Table 1. Measurements of total coliform bacteria and fecal coliform bacteria ranged from 23 to in excess of 16,000 MPN Index/100 ml. (MPN means most probable number). A geometric mean was calculated for fecal coliform results due to the high variability between samples. Happy Valley Drain and Nordhoff Drain recorded the highest levels of fecal coliform (1,655 and 1,253 mpn index/100ml, respectively) compared to the High School and Taoramina Community point sources. This may be expected due to their larger carrying capacity and acceptance of more stormwater runoff from the surrounding area. However, in every sample, coliform bacteria at the Preserve exceed the standards of the State Board of Public Health for drinking water as well as those of the U.S. Environmental Protection Agency (EPA).

Table 3
Presence of coliform bacteria from four point sources entering Ojai Meadows Preserve
mpn index/100ml

	2/18/04	2/27/04	3/3/04	3/10/04	3/16/04	Geometric mean for fecal coliform measurements
Precipitation in previous 48 hours (inches)	0.32	2.40	0.67	0.00	0.00	
Nordoff High School						
Total coliform presence	>16,000	>23.0	>16,000	>16,000	>16,000	
Fecal coliform presence	2,200	>23.0	110	5,000	80	294.8
Nordhoff Drain						
Total coliform presence	>16,000	>23.0	>16,000	>16,000	>16,000	
Fecal coliform presence	5,000	>23.0	2,400	>16,000	700	1253.2
Happy Valley Drain						
Total coliform presence	>16,000	>23.0	>16,000	>16,000	>16,000	
Fecal coliform presence	9,000	>23.0	5,000	5,000	2,400	1655.1
Taormina Drain						
Total coliform presence	>16,000	>23.0	>16,000	>16,000	>16,000	
Fecal coliform presence	3,500	>23.0	1,600	130	900	432.1

EPA standards

For water systems that collect fewer than 40 routine samples per month, no more than one sample can be total coliform-positive per month.) Every sample that has total coliform must be analyzed for either fecal coliforms or *E. coli* if two consecutive TC-positive samples, and one is also positive for *E.coli* fecal coliforms, system has an acute MCL violation.

State Board of Public Health standards

Bacteriological results must be less than 1.1 MPN to meet drinking water requirements.

Total coliform bacteria are a collection of relatively harmless microorganisms that live in large numbers in the intestines of human and warm- and cold-blooded animals. They aid in the digestion of food.

Fecal coliform bacteria are a subgroup of coliform bacteria, the most common species being *Escherichia coli*. These organisms differ from others in the total coliform group by their ability to grow at elevated temperatures. They are associated only with the fecal material of warm-blooded animals. If a large number of fecal coliform bacteria are found in water, it is possible that pathogenic (disease- or illness-causing) organisms are also present in the water. Fecal coliform by themselves are not usually pathogenic (an exception is E. coli O157:H7, which is found in the digestive tract of cattle). Rather, they are indicator organisms of the presence of other pathogenic bacteria that are more difficult to measure.

Diseases and illnesses that can be contracted by drinking water with high fecal coliform counts include typhoid fever, hepatitis A, gastroenteritis, dysentery, and ear infections. Fecal coliform, like other bacteria, can usually be killed by boiling water or by treating it with chlorine. The presence of fecal coliform bacteria in aquatic habitats indicates that the water has been contaminated with

the fecal material of humans and/or other animals. At the time this occurred, the source water may have been contaminated by pathogens or disease producing bacteria or viruses which can also exist in fecal material. The presence of fecal contamination is an indicator that a potential health risk exists for individuals exposed to this water, by touching or drinking.

b) Chemical Analysis

Table 2 summarizes the concentrations of other chemicals in the water entering the Preserve. Some suspected pollutants, such as chlorine and organochlorine pesticides, showed negligible concentrations in all samples during the two sampling periods. This is a positive result as these two chemicals can significantly inhibit plant establishment and growth, in addition to wildlife species using the water. Dissolved solids exhibited a sharp spike in concentration levels at all point sources after the 2.4 inch rainstorm immediately preceding the 2/27/04 sampling; particulates in these samples exceeded national secondary drinking water standards, and probably suggest upland erosion and sediment loads being carried into the site. Oil and grease were detected in all four locations after this rainfall event as well, in comparison to the February 18 sampling, where these chemical were negligible.

Water entering the site from the Nordhoff Drain contained surfactants (soaps and detergents) that exceeded national secondary drinking water standards on 2/18/04. Iron and Manganese exceeded national secondary drinking water standards in many samples, although both are commonly found in soils and are not associated with health hazards. If present in drinking water they can cause cosmetic discoloration to teeth and skin as well as discolor water. Chlorides from salts exhibited an abnormally high reading at the pipe entering the property from Nordhoff High School on 2/27/04.

Nitrates approached EPA contaminant levels in the Happy Valley Drain on 2/27/03. Sulfates showed a spike in concentration after the 2.4 inch rainfall event, whereas phosphate levels decreased in this second sampling period. Excess nitrates, phosphates and sulfates contribute to eutrophication ('algal blooms') in wetlands and slow-flowing streams or drains. These blooms can alter the water parameters, causing a decrease in pH and oxygen levels. These blooms deplete oxygen in the water, which in turn can kill aquatic organisms, such as fish and macroinvertebrates. In addition, some algae blooms can be toxic (such as blue-green algae), not to mention that the blooms have unattractive smells to passersby. However, biofiltration and wetland plants are effective treatments for removing excess nutrients present in stormwater runoff and thus minimizing eutrophication.

Table 4
Chemical analysis of water entering Ojai Meadows Preserve from four point sources

Mg/L

precipitation in previous 48 hours (inches)
2/18/04 - 0.32
2/27/04 - 2.4

	Chlorine	Chloride	Iron	Manganese	Phospates (P_4)	Nitrates	Sulfates	MBAS Surfactants	Total Dissolved Solids	Oil and Grease	Organochlorine Pesticides
Nordoff High School											
2/18/2004	--	4.1	1.10	0.04	0.68	--	20	0.37	110	--	--
2/27/2004	--	230.0	0.70	0.03	--	3.20	180	--	990	1.2	--
Nordhoff Drain											
2/18/2004	--	4.0	3.40	0.08	0.31	0.53	11	0.57	81	--	--
2/27/2004	--	67.0	5.90	0.10	--	1.90	120	--	510	3.6	--
Happy Valley Drain											
2/18/2004	--	11.0	3.80	0.08	0.38	1.10	32	0.12	190	--	--
2/27/2004	--	93.0	0.05	--	--	7.20	190	--	1030	1.6	--
Taormina Drain											
2/18/2004	--	3.0	0.61	0.02	0.22	--	7	0.33	64	--	--
2/27/2004	--	52.0	0.29	0.23	--	1.30	160	0.11	620	1.4	--
-- presence below practical quantification limit											
Maximum contaminant level (E	4.00					10.00					varies
National secondary drinking water standard:		250.0	0.30	0.05	n.a.	n.a.	250	0.50	500.00		varies

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IV. Habitat Restoration Plan

A careful study of historic and existing vegetation at Ojai Meadows Preserve was made in order to develop a framework for habitat restoration and enhancement. Our goals for restoring native communities center on a thorough scientific understanding of the biological, ecological, and environmental conditions at the site in order to create healthy, self-sustaining restored habitats. We aim to restore habitats that were present at the site prior to 1800. Therefore, communities not documented as ever occurring on the Preserve, such as vernal pools, are not proposed for restoration. However, we do suggest planting species known historically from wetlands in the Ojai Valley that would otherwise be lost to the community. Conservation of these rare genotypes, along with local genotypes of more common species, should be an important priority of restoration.

For each proposed habitat in this restoration plan, several factors have been considered. These include:

- hydrology, flood control, and related enhancements to water flow and quality;
- earth-moving (grading) to restore hydrologic patterns;
- soil conservation and erosion control;
- exotic species removal;
- habitat and species diversity and ecological functions;
- conservation and stewardship of local genetic and cultural types;
- establishment of conditions that will enhance sustainability of the restored habitats through time;
- history of the site (such as the Eucalyptus grove); and
- community needs and uses (such as existing viewsheds and recreation).

Condor has developed a concept for the Ojai Meadows Preserve (Map 15). This incorporates habitat restoration, wetland creation and recreational opportunities. Figure 9 provides an overview of the procedures necessary to successfully restore the Preserve. The following sections describe the main steps in sequence, which are:

1. Infrastructure Changes
2. Envisioned Landscape
3. Planting Details
4. Propagation Details
5. Trails
6. Monitoring Program
7. Performance Criteria.

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Map 15: Concept Plan

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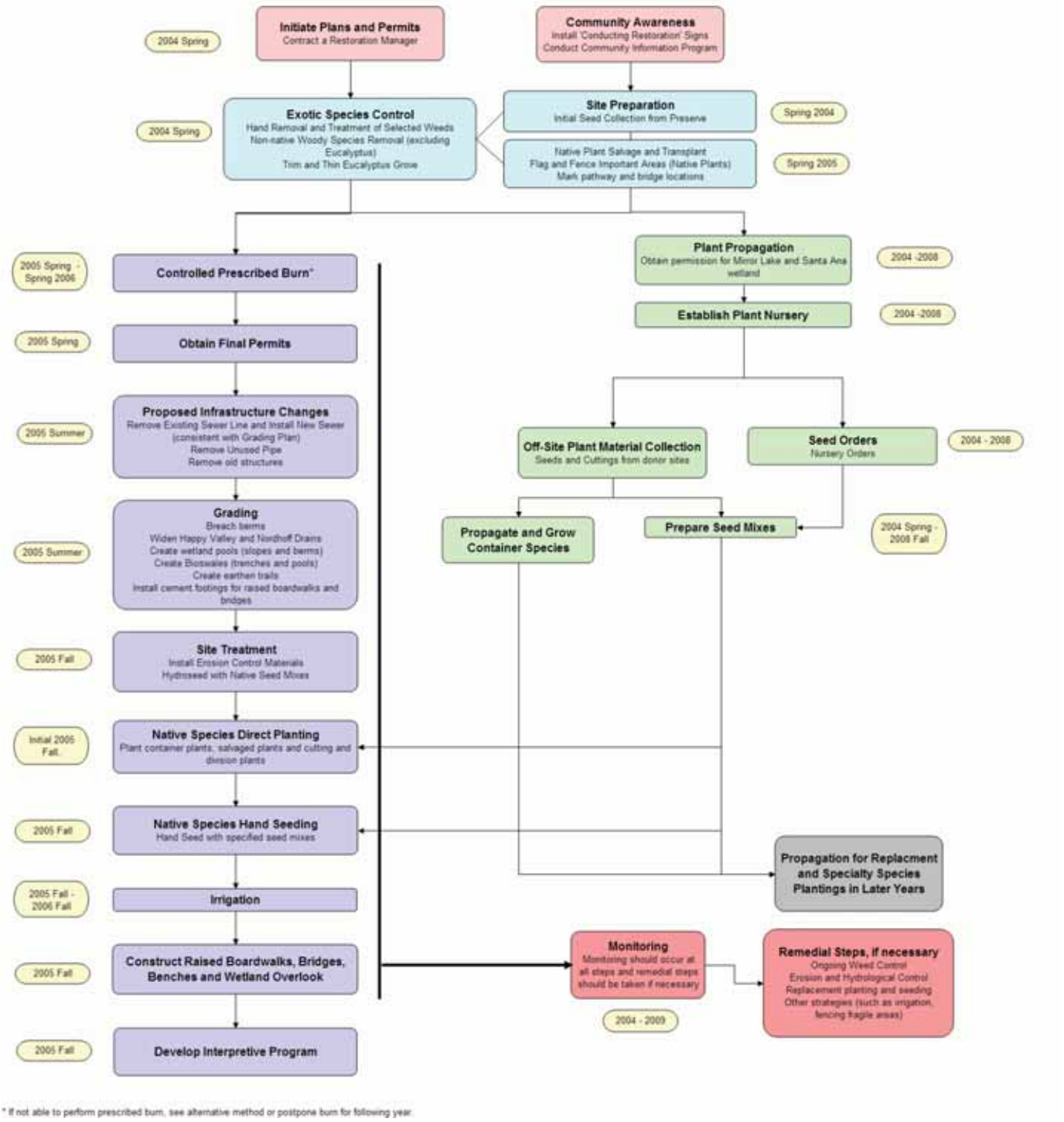

Figure 9: Restoration Implementation Schedule.

A. Infrastructure Changes

1. Sewer Lines

Four sewer pipelines belonging to the Ojai Valley Sanitary District traverse the Preserve in several locations as shown in Maps 4 and 16. All of these pipelines are buried a minimum of 5 feet beneath existing grade, and require periodic maintenance by the Ojai Valley Sanitary District with large heavy specialized trucks and machinery. However, these lines would lie beneath the restored wetlands if the lines are not moved. Based upon discussions with the Ojai Sanitary District, we understand that the pipes can be moved as long as gravity flow is maintained (John Correa, General Manager, *pers. comm*.). In order to facilitate wetland restoration, facilitate future maintenance of the lines, and avoid potential problems with sewage pipe leakages (even though this is reportedly unlikely), we recommend rerouting the sewer pipes that cross the Preserve.

We recommend that the existing sewer lines be rerouted in Year 1 prior to significantly regrading the site, utilizing a three-pronged approach to move the sewer lines away from the proposed wetlands.

a. **Taormina-Nordhoff Line.** An existing sewer line runs from the Taormina neighborhood across the Preserve from south to north along side the Eucalyptus grove and crosses the Nordhoff Drain. This line currently heads toward the proposed wetland.

   We suggest capping the present sewer line from the Taormina neighborhood as it enters the Preserve, and rerouting it so that the line would be linked with the existing sewer line south of Besant Road, approximately 15 feet north of the existing buildings (Map 16). The elevation drop is nearly 9 foot along this proposed route, thus facilitating easy gravity flow. Two alternatives are possible in this location; 1) the line could traverse the Preserve in a westerly direction and then north and connect to the terminal manhole, or 2) the line could traverse westerly for a longer span and then north to connect to the second manhole. Either of these alternatives will require an easement over the adjacent properties.

Map 16: physical changes

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b. **Highway 33-Nordhoff Drain Line.** A second sewer line enters the property at Highway 33. This line collects sewage from the northwest and the southeast. It crosses underneath the highway and then runs through the Preserve along the northwest side of the Nordhoff Drain (Map 4 and 16).

   We suggest rerouting this line. The newly rerouted line would enter the property at the same point as the existing line (at Highway 33 and the Nordhoff Drain). The new line would turn slightly to the west, and follow a straight route roughly along the 730.5 foot contour to the westerly boundary of the Preserve, and then turn south for about 100 feet where it would connect to the existing sewer line at the location of an existing manhole at an elevation of 729.5 feet. From this point it would flow in an existing line out to Meiners Oaks along El Camino Drive (Map 16). The elevation drop of this route is 1.5 feet.

   This new route would route the sewer line away from the proposed upper pool in the restored wetlands on the Preserve, and would have the added benefit of being placed under or along side a proposed new footpath traveling in the same direction. This would facilitate routine maintenance by the Sanitary District. It would also allow another 600 linear feet of sewer line to be decommissioned, thus potentially saving the Sanitary District money for repairing or replacing lines in the future.

   An alternative exists that would route the new pipe through Church property. This area is undeveloped and does not appear to be used by the Church. This alternative would have the advantage of being in a straighter line and could decommission 600 linear feet of existing sewer line. It has the disadvantage of requiring the approval of another property owner (Map 16).

2. Undetermined Pipe

A pipe is located under the berm on the Preserve, running north to south adjacent to the Eucalyptus Grove and crosses the Nordhoff Drain. According to the Ojai Valley Sanitary District, this pipe is not a County or City structure (Correa *pers. comm.*, Hawks *pers. comm.*). We propose removal of this pipe at the same time as removing the sewer line and the berm. Caution should be taken when removing this pipe due to its unknown contents.

3. Old Building Pad and Driveway

An old building pad and remains of an asphalt driveway are present on the west side of the property, south of Meiners Oaks Elementary School. These should also be removed at the commencement of the project with the other infrastructure changes.

B. Envisioned Landscape

1. Vegetation Concepts

Prior to 1800, the Ojai Meadows Preserve site was dominated by oaks, native grasses, and a large wetland area. Small amounts of coastal sage scrub may have also been present. We propose to restore these communities in locations that make sense for each community, given today's constraints and possibilities (see Map 15).

Condor Environmental proposes to restore four upland communities and three wetland communities on the Preserve (Map 15). These include:

Table 5
Proposed Plant Community Acreage

Plant Community	Current Acreage	Proposed Acreage
Native		
Riparian Woodland	1.3	4.2
Freshwater Marsh	0.3	2.7
Wet Meadow	0	1.4
Wetland Habitat Subtotal	***1.6***	***8.3***
Native Grassland and Valley Oak Savanna	1.6	22.6
Coast Live Oak Woodland	0.8	21.7
Coastal Sage Scrub	0	1.7
Upland Habitat Subtotal	***2.4***	***46***
Non-Native		
Eucalyptus Grove	4.5	2.7
Non-native Woody Plantings	1.6	0
Non-native Grassland	46.6	0
Non-Native Habitat Subtotal	***52.7***	***2.7***
Approximate Total	**57**	**57**

The following paragraphs provide a brief summary. Each community is described in detail in the following sections and each is intended as a stand alone section to facilitate ease of implementation.

2. Wetlands

Wetland restoration will focus on several objectives, including flood control, water quality enhancement, and restoration of three types of wetlands on the Preserve. There are currently four point sources of water into the Preserve: the Nordhoff Drain, which drains the Cuyama Meadows property and environs; the Happy Valley Drain, which receives runoff from storm drains and an unnamed drainage to the northeast of the Preserve; runoff from the Taormina community, which enters the Preserve through two pipes at the southern end of the *Eucalyptus* grove,

and runoff from Nordhoff High School, which enters the site from a pipe on the east side of the property (See Map 4).

The amount of water entering the Preserve is expected to increase by 30 percent due to ongoing improvements on the high school property (Krumpschmidt *pers. comm.*). Condor proposes changes to each of the channels receiving water on the Preserve in order to maximize flood control capacity during flood events while also developing sustainable wetland communities. A combination of rerouting and regrading the drainages will be utilized to create riparian woodland, wet meadows and freshwater marsh environments. These changes are described in more detail in the next section.

3. Native Grassland and Valley Oak Savanna

Once drainage issues are addressed, Valley Oak Savanna will be restored to the northern and eastern portions of the Preserve in association with native grassland. Attempts to resuscitate the remaining large Valley Oaks as well as to protect and expand the small population of Valley Oak seedlings and saplings will receive first priority, followed by new plantings of oaks and establishment of a representative understory. Conversion of non-native grassland to native grassland and Valley Oak Savanna will be an exciting undertaking, the first of its kind in the Ojai Valley.

4. Coast Live Oak Woodland

We propose restoring Coast Live Oak Woodland to the "Besant Meadows" area, northwest of the Happy Valley Drain near the Meiners Oaks Elementary School and continuing through the present eucalyptus grove and into the southwestern corner of the property. On the southeastern portion of the Preserve east of the *Eucalyptus* grove, houses line the southern perimeter of the Preserve. Therefore, we suggest a more savanna-like arrangement of Coast Live Oaks in this sector, with scattered clumps of Coast Live Oaks and associated understory species interspersed with native grassland between the oak clusters. This arrangement will allow homeowners to continue to enjoy scenic views of the meadow and mountains while restoring native oak communities.

5. Coastal Sage Scrub

A few small mounds of Coastal Sage Scrub will dot the landscape within the native grassland and Valley Oak Savanna, utilizing soil removed during grading for wetland creation. Patches of coastal sage scrub will provide critical wildlife habitat, enhance botanical diversity, and restore a lost environment to the Preserve.

6. Trails and Access Points

The existing system of trails is used by community residents for recreation as well as direct transportation routes (to and from the high school, for example), as shown in Map 4. The goals of the proposed trail system is to maintain current patterns of movement with only slight deviation, while protecting wetlands and other restored habitat areas, and providing opportunities for solitude, quiet nature appreciation and active learning.

Two types of trails area proposed within the Preserve, earthen and raised boardwalks. The earthen paths are located in similar locations to the existing trails, with a couple of trail additions, such as on the south side of Nordhoff Drain. Over 9,000 linear feet of earthen paths will be maintained or created with the restoration project. In addition, two main raised boardwalk trails are proposed in the areas of wetland creation. Approximately 780 linear feet of raised boardwalks will be constructed of wood or other suitable material and will be raised off the ground a minimum of 1 foot, above the flood line. The boardwalks will help facilitate use of the Preserve for disabled people and will minimize disturbance to vegetation. These trails will cross and meander through the Upper Wet Meadow and along the Savanna and Taormina stream channels. These trails will enable the community to enjoy the Preserve year round and appreciate the newly created habitats.

A wetland overlook will be constructed on the northern bank of the Freshwater Marsh, looking out towards the seasonal island which is envisioned as a wildlife sanctuary. This will be a viewing area and will allow preserve users to pause and enjoy their surrounds and overlook the dense riparian areas along Nordhoff and Happy Valley stream channels and also to look back upon the Upper and Lower Wet Meadows. This could also be an area of interpretation with signage about the restoration effort. Several bench locations are also suggested within the restoration project. These further enhance use of the Preserve and facilitate quiet sitting and reflection in nature and may also be used for educational purposes, such as enabling small class seating.

To accommodate existing patterns of movement, six bridges will be needed to cross the Happy Valley and Nordhoff stream channels as well as the Savanna and Taormina stream channels. The bridges will range in length from 20 to 150 feet. They will allow crossing of the stream channels year round. It may be possible to use raised boardwalks in some locations, such as Taormina stream channel, in place of bridges depending on cost and type of crossing necessary.

An access road is required by the County of Ventura Watershed Protection District to the Happy Valley stream channel. Routine flood control maintenance may be required to check the functioning of the channel, especially after flood events. This

is proposed in approximately the same location, 20-40 feet from the channel with two access points to the bank slope. The access road to the church at the northern end of the Preserve will remain intact.

Table 6
Trail Measurements

Type of Trail	Proposed * Distance (Linear Feet)
Earthen Trail	9,000
Raised Boardwalk	780

**** Includes some existing trails.***

C. Proposed Wetlands

1. Location and Layout of Proposed Wetlands

Restoration of 8.3 acres of wetlands at the Ojai Meadows Preserve will center on the site of the historic 4.5 acre wetland and drainages visible in the 1929 aerial photograph. Although all of the drainages into the wetland have been altered, there are four points from which water enters the Ojai Meadows Preserve today from offsite, in addition to annual precipitation. These points are: the Nordhoff Drain, which drains the Cuyama Meadows property and environs; the Happy Valley Drain, which receives runoff from storm drains and an unnamed drainage to the northeast of the Preserve; runoff from the Taormina community, which enters the Preserve through a pipe at the southern end of the *Eucalyptus* grove; and runoff from Nordhoff High School, which enters the site from a pipe on the east side of the property (Map 15). In addition, there are places that collect water after a rain, such as pools in the grassland between the Nordhoff Drain and the High School.

According to Mike Krumpschmidt of Nordhoff High School, plans for a new stadium and proposed rerouting of irrigation water runoff on the High School campus will result in a 30% increase in water entering the Ojai Meadows Preserve from the pipe on the eastern border of the Preserve. Previously, this water exited the school onto the highway, and entered the Preserve in the Nordhoff Drain. The amount and rate of runoff that will come from the Cuyama Meadows property in the future will depend on whether it is developed, the type of development, and how much permeable and impermeable land will remain. These questions remain unanswered for the time being.

2. Wetland Design

a) Design Overview

The restored wetlands at the Ojai Meadows Preserve will include enhancements to hydrology, water chemistry, ecological processes, and aesthetics. Wetland functions to be augmented include flood reduction, sediment and erosion control, biofiltration, enhanced biodiversity, genotype and habitat restoration, refugia for endangered species, and ecological integration of wetlands into the context of the larger surrounding environment.

While habitat restoration is often defined as putting something back "the way it was," for the wetlands at Ojai Meadows Preserve, we aim to enhance existing conditions, remove exotic species, recover native species, and restore wetland functions. We propose that all water entering the Ojai Meadows Preserve be captured and directed through carefully designed channels and "stepped wetlands" to the site of the original wetland. Because water entering the site may

contain hydrocarbons and a variety of other pollutants, bioswales are proposed near the various water input sources. The plants proposed for these bioswales have been selected for their ability to filter pollutants.

Wetlands operate like giant sponges in that they slow down and absorb excess stormwater runoff, then gradually release the water over a prolonged period. A strong positive relationship exists between the complexity of upstream wetlands available for water percolation and the rate of peak water flow during flooding conditions. As a result, we propose adding meanders and elongated pathways to stream channels to increase percolation and slow down water velocities. To further reduce flood control risks, we recommend specific measures to prevent or minimize disruption of soils during the construction process and to promote rapid establishment of plant cover afterwards.

Objectives of this effort include rapid stabilization of soil and graded banks, reestablishment of native vegetation using genetically and ecologically compatible propagules, creation of suitable environments for the establishment of native wetland species by natural means, and ongoing vigilance to ensure that the revegetated areas are relatively free of invasive weedy species that interfere with restoration efforts.

In addition, due to the dramatic decline of various wetland habitats and species in the Ojai Valley, this restoration effort has the exciting and unusual opportunity of returning a variety of rare wetland species to the Valley that had been extirpated in recent decades.

b) Engineering Specifications

The existing hydrology of the Ojai Meadows Preserve is discussed earlier in this Plan. The engineering details of the proposed wetland creation are presented here, with habitat restoration features discussed afterward. Map 17 shows the specifications of the proposed wetlands. These dimensions are preliminary and will require further refinement in the course of developing final grading plans. For Construction Guidelines – please see Section VI.

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Map 17: grading

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(1) Savanna Stream

The Savanna Stream is proposed to be created utilizing the water runoff from the high school. Presently, the outlet pipes draining water from Nordhoff High School are on the boundary between the Preserve and the school. Engineers for the School District estimate that the storm water flow coming out of these pipes is 100 cubic feet per second (cfs). One of the original goals of the project was to evaluate the potential for re-use of this water by Nordhoff High School. After carefully making such an evaluation, the authors of this plan conclude that it is not feasible to re-pipe or pump water from the Savanna Stream or any other location of the Preserve to the high school because the Preserve is at a lower elevation than the school. Therefore, re-use of the water would likely require a mechanical solution that would include pipes, pumps, motors and would be fundamentally at odds with both the practical and aesthetic goals of wetland restoration.

Catch Basin. To increase the aesthetic appeal of this area, we propose enhancement of the existing catch basin on the Preserve at this point, consisting of existing and additional sandstone boulders. The boulders would be placed in a manner that will conceal the pipes and reduce the velocity and scouring potential of the water entering the Savanna. The visual appearance of the basin will be enhanced by planting of willows and other fast growing species.

The initial water quality sampling results indicate that a filtration device is not necessary. Instead, the proposed bioswales are expected to adequately filter the runoff water, assuming continuation of existing runoff content from the school. However, routine maintenance and removal of vegetation and debris (including trash) may be necessary. A trash collection device at the input(s) of the drain on school property was recently installed.

Stream Channel and Bioswales. A meandering stream channel would be constructed to direct water from the catch basin to the Nordhoff Drain. The channel would be 1.5 feet deep, 4 feet wide at its bottom, and 13 feet wide at its top. The bank slopes of the channel would be graded with a 3:1 inclination (that is 3 feet horizontal to one foot vertical rise). Within the channel, three shallow bioswales would be created, allowing water to pond in these locations. The three bioswales are to be created at the 731, 732, and 735 foot contour lines. The bioswales would be 30 feet wide, 1.5 deep and would have 15:1 slopes.

The channel and bioswales would be entirely earthen. The meandering stream would fork and become two channels at the 732 foot contour line in order to increase habitat diversity and enable a moist riparian forest to become established between them. This secondary channel would have the same dimensions as the

first. The two stream channels would continue to flow toward their confluence with the Nordhoff Stream Channel.

(2) Taormina Stream

The Taormina Stream is proposed to be constructed in the southern portion of the property, utilizing water runoff coming from the Taormina residential neighborhood. Two adjacent inlet pipes conveying runoff from the Taormina neighborhood are located at the boundary of the Preserve. Condor estimates that the flow coming from these pipes is 29 cfs during 2-year, 24-hour, storm events. A large amount of gullying and erosion has occurred in this area due to the unmanaged nature and speed of water entering the Preserve through these pipes.

Catch Basin. We propose construction of a catch basin 4 feet wide and 3 feet deep containing small sandstone boulders that would catch the runoff and direct it toward a constructed stream channel ("the Taormina Stream") that would flow toward the Nordhoff Drain, the mouth of the Savanna stream, and associated riparian forest.

Stream Channel. A meandering stream channel (850 feet in length) would be located to the east of the Eucalyptus grove and would eventually intersect with the proposed lower Savanna stream and riparian forest. The channel would be 1.5 feet deep with a bottom width of 4 feet and a top width (top of bank to top of bank) of 13 feet. The slopes of the stream channel would have a gentle 3:1 slope and would be earthen with no hard bank protection. The stream channel would fork at the 730 foot contour line to provide increased habitat diversity before joining the Nordhoff Stream Channel.

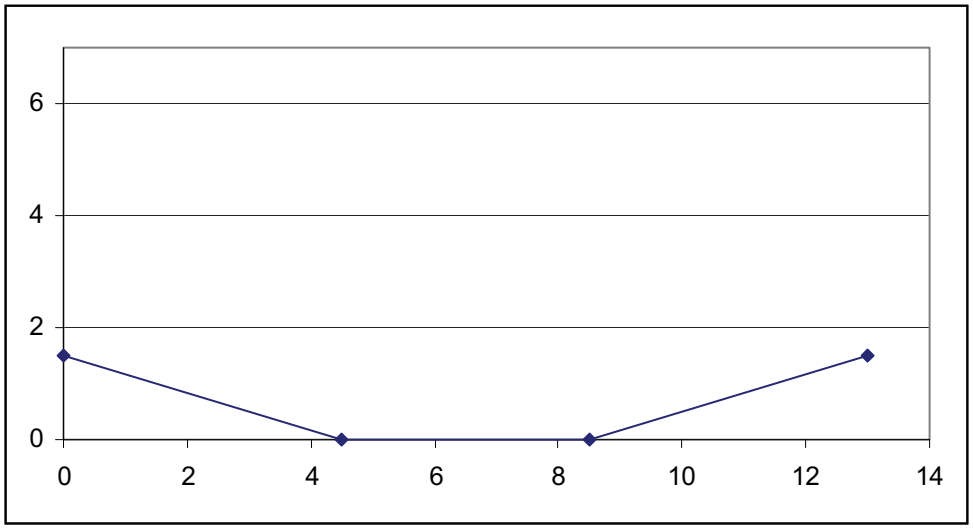

Figure 10: Proposed average cross sections of the Eastern and Taormina channels (bank slope = 3:1 (3 foot horizontal distance over 1 foot rise), bankfull discharge > 30 ft^3s^{-1}).

(3) Nordhoff Stream Channel ("Nordhoff Drain")

Inverted Gradient. The topographic survey conducted for this Plan found that the elevation of the bottom of the Nordhoff Drain on the upstream (Cuyama Meadow) side of Highway 33 is 729.14 feet, and the elevation of the bottom of the drain as it enters the Preserve south of Highway 33 is 730.01. Thus, there is an inverted gradient at the drain's headwaters, contributing to flooding of the highway.

Sediment and Debris. The sediment and vegetative debris in the culvert under Highway 33 will be cleared out as well as the sediment and debris within the Nordhoff Drain on the Preserve and on the Cuyama Meadow side of the highway within Caltrans Right of Way. (This will be done after salvaging and transplanting desired native plants.)

Stream Channel. We propose to grade the Nordhoff Drain with a longitudinal slope of 0.362%, starting with a thalweg elevation of 727.00 feet at Highway 33 and dropping in elevation towards the confluence with Happy Valley Drain. The drain will be widened to a bottom width of 20 feet, a depth of 4.21 feet, and a top width of 45.26 feet (with 3:1 bank slopes). This will accommodate a bankfull discharge in excess of 760 cubic feet per second (cfs), thus providing conveyance of runoff produced by the 25-year 24-hour storm event, as long as compatible changes are made to the Happy Valley Drain as proposed below. In other words, the flooding situation will be improved. Whereas the highway floods currently during 2-year 24-hour storms, after implementation of the proposed improvements to the Nordhoff and Happy Valley Drains, no flooding is expected to occur during 25-year 24-hour storms.

In order to prevent growth of vegetation that would block sediment and plug the drain, riparian trees and shrubs will be planted along its banks, thus shading out problematic plants. Although this is likely to be successful in the long term, periodic vegetation removal in the channel, particularly in the short term, may be needed. Careful planning will be necessary to protect rare plants established in the channel.

A meander within the stream channel will be constructed 200 feet southwest of the highway in order to protect a Valley Oak on the northern side of the drain and the cluster of young Valley Oaks on the south side of the drain.

Berm. The berm on the south side of Nordhoff drain upon which the young oaks are growing will remain and be modified so that it is a broad mound. The rest of the 2- foot tall berm extending to the south will be removed. Because the water from the High School and the Taormina neighborhood will be controlled by directing it to the Nordhoff Drain via a constructed stream channel, the need for a berm at this location will be eliminated. Its removal will also allow surface and

subsurface runoff to flow unimpeded to the Nordhoff stream channel, instead of collecting around the bases of the Valley Oaks. This will improve the chance of survival for these trees.

Upper Wet Meadow. Two wet meadows will be created along the length of the Nordhoff Stream Channel. The Upper Wet Meadow will be created 260 feet southwest of Highway 33 and will extend 380 feet along the northern side of the Nordhoff Stream Channel, as presently configured.

The concept behind this wet meadow is to allow for low rainfall runoff, such as 'first flush' winter rains, to remain onsite and infiltrate the soil, creating a seasonal wetland. The vegetation in this area will transition from riparian scrub at the top, to wet meadow in the middle, to freshwater marsh at the bottom (in standing water). We expect that shallow water will be standing at the lowest elevation of the meadow even in the summers of average rainfall years, as it does currently.

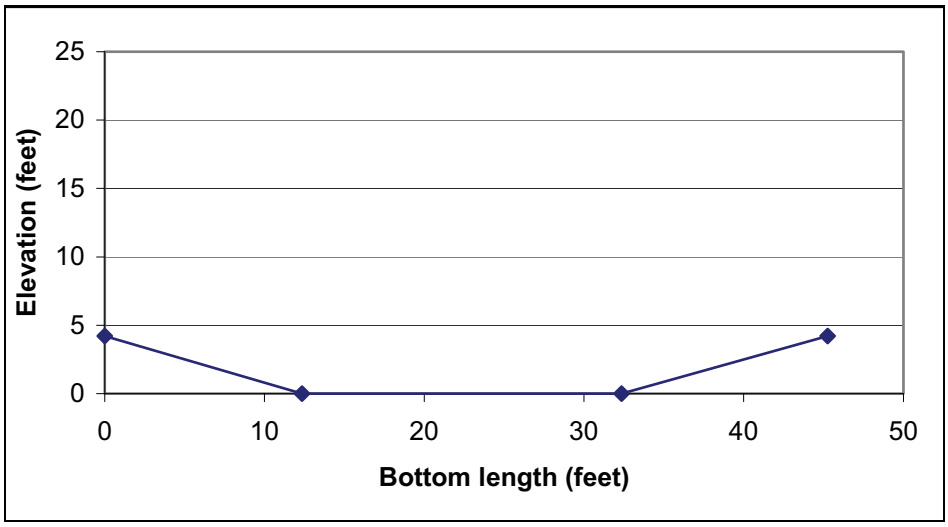

Figure 11: Proposed average cross sections of the Nordhoff Drain (bank slope = 3:1, bankfull discharge larger than 760 ft^3s^{-1}).

The Upper Wet Meadow will be approximately 1 acre in size, and will have a bottom elevation of 726 feet (making the Upper Wet Meadow approximately 4 feet deeper than the surrounding upland). It will have a bottom width of 195 feet and a top width of 215 feet, with a bank slope of 3:1. A gentle slope towards the Nordhoff drain, will encourage slow rather than rapid movement of water. The elevation of the surrounding terrain (approximately 730 feet) will ensure that runoff does not spill out of the meadow into neighboring areas, but, rather, that it flow towards the proposed Nordhoff Stream Channel.

A low rocky berm will cross the outlet of the channel at an elevation of 727.5 feet to encourage ponding in the Upper Wet Meadow above while not causing flooding

during high water flows. The formation of the Upper Wet Meadow will require a small berm on its southwestern side to achieve an elevation equal to 730.00 feet there. A narrow stream channel will drain the Upper Wet Meadow. This narrow segment will have approximately a 20 foot bottom width with gently bank slopes of 3:1.

Changes in Hydrology from Cuyama Meadow. Urban development on the Cuyama Meadow property (for which no City application has been filed) could affect the Nordhoff Stream Channel and proposed wetlands on the Ojai Meadows Preserve. Precisely what that effect would be is unknown at this time and beyond the scope of this plan.

Lower Wet Meadow. A second, lower, meadow is proposed. The Lower Wet Meadow will be smaller than the Upper Wet Meadow. This lower meadow will be 0.3 acres, having a bottom width of 80 feet, a top width of 95 feet, and surrounded by land whose elevation is defined by the existing 729.00 foot contour. The floor of the Lower Wet Meadow will be excavated down to approximately 725 feet. The maximum depth of water in the Lower Wet Meadow will be 1 foot as the outflow into the Nordhoff Channel will be a perched, rocky, berm at 726 feet. The Lower Wet Meadow will also receive inflow from the Savanna Stream coming from Nordhoff High School and the Taormina Stream.

Downstream from the two meadows, the Nordhoff drain will narrow down to the minimum bottom width of 20 feet before emptying into a large marsh at the confluence of the Nordhoff Drain and Happy Valley Drain.

Freshwater Marsh. This wetland at the confluence of the two drains would be constructed by removing the soil between the two drains down to an elevation of 723.45 feet. In other words, 5 to 6 feet of soil will be excavated from the land between the two drains at their confluence. Further, the banks of the two drains will be recontoured so that a continuous 0.9 acre wetland is formed. In order to do this grading, about one third of the existing Eucalyptus Grove will be removed. After grading is completed, a riparian forest of native, fast growing trees will be planted. The 729.00 foot contour will serve as the northeastern boundary of the sloping banks leading to the marsh, whose bottom would be at the 723.45 feet level.

The existing elevation of the bottom of Happy Valley Drain at the confluence with the Nordhoff drain is 724.34 feet. The Happy Valley drain will be deepened, by approximately one foot, to 723.45 feet. It will remain at this elevation from the confluence to its downstream exit from the Preserve. As it leaves the Preserve, it presently has an elevation of 723.45 feet. This will remain unchanged. It will allow flow in the drain to spread onto the marsh even under low-flow conditions.

During high-flow storm events storm water will flow towards the western exit of the Preserve in both the Nordhoff and Happy Valley drains driven by hydraulic gradients in that direction.

Island in the Marsh. A small island, of irregular topography (no higher than 727 feet), will be created in the center of the freshwater marsh to create wildlife habitat and an opportunity for nature appreciation.

(4) Happy Valley Drain

Happy Valley Drain within the Preserve will be widened to a bottom width of 27 feet, and retain its existing depth of 5.43 feet. We propose modification of its banks, creating slopes of 3:1, creating a top width (bank to bank) of 59.6 feet. At the confluence with Nordhoff Drain, it will be widened into the freshwater marsh as described above, and its bottom will be deepened there to a depth of 723.45 feet. As the drain exits the Preserve it will gradually be reduced in width to coincide with the same dimensions as the existing cement box at the edge of the property. It will remain at this elevation all the way to its exit from the property. The bottom elevation is currently 723.45 feet, which is 2 feet higher than the elevation of the bottom of the concrete channel on the adjacent property. Therefore, there will not be an impediment to water exiting the Preserve. Preliminary discussion with the City of Ojai Engineer and the County of Ventura Watershed Protection District have been favorable and the conceptual design viewed as beneficial.

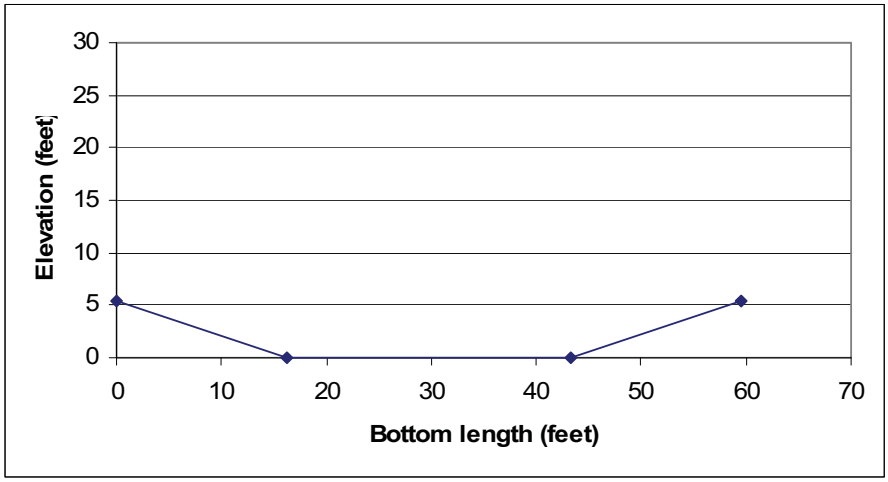

Figure 12: Proposed average cross sections of Happy Valley Drain (bank slope = 3:1, bankfull discharge approximately 2200 ft^3s^{-1}).

(5) Cut and Fill

To minimize costs, all soil cut on the site should be used as fill on site, thus balancing cut and fill on the Preserve, and avoiding trucking soils off the site. This will need to be confirmed based upon calculations during the course of preparation of final grading plans. Topsoil, once removed from the proposed wetland areas, should be set aside for later use in the constructed wetlands. Five sites will be specified to receive soil not needed in the above mentioned berms and wet meadows. These sites will be mounded to create naturalistic shapes and then seeded and/or planted with Coastal Sage Scrub. The five mounds should be created with deeper fill (not topsoil) and topsoil layered over the mounds.

Table 7
Earth-Moving Estimates

Feature to Excavate or Remove	Cubic Feet	Cubic Yards
Berm Removal	5,556	206
Excavation of Upper Meadow	217,800	8,067
Excavation of Lower Meadow	65,340	2,420
Excavation of Freshwater Marsh	235,224	8,712
Excavation of Taormina Stream Channel	10,838	401
Excavation of Savanna Stream Channel	12,750	472
Excavation of Nordhoff Stream Channel	118,522	4,390
Excavation of Happy Valley Stream Channel	121,906	4,515
Total	**787,936**	**29,183**

3. Riparian Woodland

Riparian Woodland vegetation is proposed for borders of water ways on site that receive moisture all year. These include the borders of the Nordhoff stream channel and Happy Valley Drain, and a swath near the Nordhoff stream channel that receives runoff from Nordhoff High School, after it passes through a series of bioswales. In addition, we propose creating a showcase Riparian Forest at the confluence of the Happy Valley and Nordhoff Drains that includes an island and significantly regraded streambanks. This towering forest of gorgeous native trees will replace Eucalyptus found at this confluence, although the majority of the existing grove will be preserved to the south of these drains.

Container-grown specimens of large riparian trees such as Western Sycamore (*Plantanus racemosa*), Southern California Black Walnut (*Juglans californica*), and White Alder (*Alnus rhombifolia*) should be planted in shady areas along wet stream channels. Willow (*Salix* species) and Fremont Cottonwood (*Populus fremontii*) will also be planted. These tree species will provide shade for understory species as well as shade the stream, which in turn will limit excessive proliferation of wetland marsh species such as Southern Cattail (*Typha domingensis*), which can choke stream channels, thereby reducing available oxygen and exacerbating flooding.

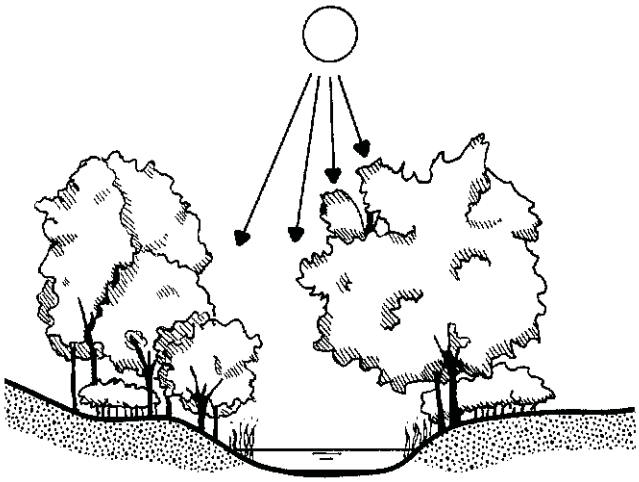

Figure 13: Example of a vegetated bank for riparian woodland. Trees and shrubs should shade a significant amount of channel bank. Most of the channel should be shaded at midday. (Marble 1992).

In sunny and/or seasonally flooded locations, Arroyo Willow (*Salix lasiolepis*), Mulefat (*Baccharis salicifolia*), Mexican Elderberry (*Sambucus mexicana*), California Blackberry (*Rubus ursinus*), California Wild Rose (*Rosa californica*), Mugwort (*Artemisia douglasiana*), and Douglas' Baccharis (*Baccharis douglasiana*) are

proposed. Other associates that should be planted in the riparian zone include Giant Chain Fern (*Woodwardia fimbriata*), Shrubby Connate Honeysuckle (*Lonicera interrupta*), and Creek Clematis (*Clematis ligusticifolia*). Common Monkeyflower (*Mimulus guttatus*) and Scartlet Monkeyflower (*M. cardinalis*), Horsetail (*Equisetum* species), Iris-leaved Rush (*Juncus xiphioides*), and Blue Lobelia (*Lobelia dunnii*) are a few of the many herbaceous perennials that should also be planted along stream channels.

Table 8
Proposed Species List for Riparian Woodland
Nordhoff Stream Channel and Happy Valley Drain

Species	Habit	Found at the Ojai Meadows Preserve?
Arroyo Willow (*Salix lasiolepis*)	Shrub/tree	Yes
Red Willow (*Salix laevigata)*	Tree	Yes
Yellow Willow (*Salix lucida* subsp. *lasiandra)*	Tree	Yes
Western Sycamore (*Platanus racemosa*)	Tree	Not on site, but in Ojai area
Fremont Cottonwood (*Populus fremontii*)	Tree	Not on site, but in Ojai area
White Alder (*Alnus rhombifolia*)	Tree	Not on site, but in Ojai area
Bigleaf Maple (*Acer macrophyllum*)	Tree	Not on site, but in Ojai area
Southern California Black Walnut (*Juglans californica*)	Tree	Not on site, but in Ojai area
Mulefat (*Baccharis salicifolia*)	Shrub	Yes

Table 9
Planting Plan for 4.2 acres of Riparian Woodland

Species	Total Plants	Propagation
Western Sycamore *(Platanus racemosa)*	**306**	Container
California Black Walnut (*Juglans californica*)	**102**	Container
Bigleaf Maple (*Acer macrophyllum*)	**34**	Container
Mexican Elderberry (*Sambucus mexicana*)	**50**	Container
Cottonwood (*Populus fremontii*)	**102**	Container, direct cuttings
Willow (*Salix lasiolepis,S. laevigata, S. lucida subsp. lasiandra*)	**100**	Container, direct cuttings
White Alder (*Alnus rhombifolia*)	**102**	Container
California Blackberry (*Rubus ursinus*)	**40**	Container

a) Planting of container-grown plants:

Container-grown plants should be laid out in irregular and naturalistic groupings by the Restoration Manager. All plantings should take place in autumn after grading and weed eradication efforts are deemed successful.

Holes should be dug to a depth and width that barely exceeds the size of the containers the plants have been grown in. The Restoration Manager should make a judgment as to the need for gopher cages. If needed, a cylindrical gopher cage made of one-half-inch chicken wire should be placed in the hole. This cage should have no bottom and be 19 inches high and 8 to 10 inches wide. Prior to placing a young tree or shrub into a planting hole, soil inoculum from commercial sources may be added.

Shade cloth may be utilized if seedlings appear to need shade; this will be determined by the Restoration Manager. Once the container grown plant has been planted, it should be deeply watered. Each tree or shrub will be marked with a numbered tag that references information on seed source, propagation, time of planting and other pertinent information. This information will provide valuable clues should there be uneven patterns of success or failure.

Willow (*Salix* species) and Fremont Cottonwood (*Populus fremontii*) can be planted as cuttings or poles, and should be placed closer to the stream than the sycamores, walnuts, and alders.

b) Cuttings for riparian plantings

One effective means of establishing willows and cottonwoods in riparian settings is to take woody cuttings from nearby individuals and place the cutting directly in the ground, rather than propagating the cuttings in a nursery first. Cuttings should be one-half to two inches in diameter and one to three feet long. Larger cuttings ("poles") can also be taken (up to eight feet long) and are particularly effective in upper bank plantings since they can be pushed deeper into the ground so as to be closer to the water table.

Cuttings and poles should be carefully selected from parent trees or shrubs and immediately placed in water. The planting end should be sharpened to a point. Holes can be dug in the soil with a digging pole or rebar and then the cutting can be placed in the hole. Most (three-quarters) of the cutting can be buried to ensure proximity to groundwater. Cuttings should be arranged in a random pattern of 3 per square yard.

c) Seed Mix for Wetlands

We propose the use of a special seed mix for riparian woodland and wet meadow banks that can be hydroseeded over the entire designated area to provided soil

stabilization and weed suppression. This should be done in the fall of the first year of planting between September and November.

Table 10
Wetland Erosion Control Seed Mix
(*application rates courtesy of S and S Seeds*)

Species	Percentage of seed mix	Seed application rate (pounds/acre)
California Brome (*Bromus carinatus*)	36%	20
Meadow Barley (*Hordeum brachyantherum*)	14%	8
Tomcat Clover (*Trifolium tridentatum*)	14%	8
Small Fescue (*Vulpia microstachys*)	14%	8
Creek Clover *(Trifolium obtusiflorum)*	14%	8
Rush *(Juncus* species)	8%	4

Hydroseeding seed mixtures will be applied in a flexible growth medium and incorporate the specified seed mix and appropriate fertilizer, mycorrhizae inoculum, and a soil conditioner or humate. Final application rates will be agreed upon between the Restoration Manager and the seeding contractor. Work will be conducted by a reputable hydroseed contractor who will be required to hydroseed using the seed mix and application rate specified in this plan.

To avoid accidental introduction of non-native weeds during the hydroseeding process, the hydroseed contractor will be required to rinse the tank and all hoses and nozzles prior to arrival at the site. The Restoration Manager must be present to verify that the appropriate seed mix is used. Seed bag tags will be submitted to the Restoration Manager for verification. Unless authorized by the Restoration Manager, the seed mixture will not be added to the hydromulch in the tank until approval has been given and the hydroseed contractor is ready to apply the mixture.

All seeded areas should be irrigated after sowing and kept moist through the germination period.

d) Erosion control

Because Riparian Woodland vegetation will occur on slopes next to wetland channels, slope stabilization will be an important component of Riparian Woodland restoration. Use of coconut or jute netting on all plantings will be necessary. Netting should be secured with metal stakes placed every 9 to 12 inches.

Sediment barriers and/or water bars should be placed at regular intervals down slopes to divert large accumulations of sediment and/or water. These barriers should remain in place until the surface of the ground is revegetated with deep-rooted native plants. If necessary, they should be cleaned out or reformed prior to the completion of revegetation. See *Section VI.: Construction Guidelines* for more information.

4. Wet Meadow

Proposed wet meadow vegetation will occur in a variety of restored wetlands on the Preserve. Wet meadow vegetation will be planted in the bioswales descending from Nordhoff High School, as well as in patches of moist ground between the meandering stream channels close to Nordhoff Drain and Happy Valley Drain. Expanses of wet meadows will be restored to the gently contoured, regraded slopes along portions of the Nordhoff stream channel and Happy Valley Drain.

A combination of transplanting, container-grown material, direct seeding, and use of excavated soil may be used for restoring wet meadow vegetation. It is strongly recommended that the bulk of the restoration material be planted from live material that is salvaged, transplanted or grown in containers in order to rapidly establish desired vegetation and inhibit weed establishment. Collection numbers and associated documentation, along with propagation logs should be maintained for all plant material (see Seed and Propagule Propagation section below).

a) Salvaging, Transplanting, and Container-grown Stock

Salvaging and transplanting wet meadow species already on the Preserve will be necessary in order to preserve the local genotypes during grading of drainages. Plants to be salvaged include:

- Common Spikerush (*Eleocharis macrostachya*)
- Mexican Rush (*Juncus mexicanus*)
- Brown-headed Rush (*Juncus phaeocephalus*)
- Meadow Barley (*Hordeum brachyantherum*)

Transplanting wet meadow species from nearby donor sites, such as Mirror Lake and Santa Ana wetland, is also recommended. Wet meadow herbaceous perennials to be obtained from donor sites include:

- Needle Spikerush (*Eleocharis acicularis*)
- Common Spikerush (*Eleocharis macrostachya*)
- Montevideo Spikerush (*Eleocharis montevidensis*)
- Mexican Rush (*Juncus mexicanus*)

- Indian Rush (*Juncus textilis*)
- Meadow Barley (*Hordeum brachyantherum*)
- Alkali Rye (*Leymus triticoides*)
- Bugle Hedge-nettle (*Stachys ajugoides*)

Rhizomes and/or whole plants of desired species can be dug and placed in large plastic bags or buckets. These should be transplanted at the Preserve within 36 hours. Those that cannot be planted soon after digging should be placed in containers and grown in a nursery.

The Restoration Manager may also elect to propagate some of these plants in a nursery in order to maximize the number of individual available for outplanting, especially those that occur in low numbers in the wild. In addition, some of these plants may not be readily available and may be grown in a nursery from seed or cuttings before being planted at the Preserve. At least one year should be allowed for growing many container-grown marsh plants to an appropriate size for outplanting.

b) Seed Mix for Wetlands

The wetland erosion control seed mix is described above in the section on Riparian Woodland. In addition, rare Ojai wetland genotypes known from wet meadow habitats and the margins of pools and ponds may become established by judicious use of broadcast seeding. Some of these are found in vernal pools as well as in exposed areas of wet meadows. Seeds of these plants may be obtained from nearby donor wetlands such as Mirror Lake and Santa Ana wetland. Plants that may become established in this manner include all of the afore-mentioned species plus:

- Slender Aster (*Aster subulatus*)
- Water Pygmy Weed (*Crassula aquatica*)
- Wooly Everlasting (*Gnaphalium palustre*)
- California Loosestrife (*Lythrum californicum*)
- Dotted Smartweed (*Polygonum punctatum*)
- Purslane Speedwell (*Veronica peregrina*)

Seed germination for most of these plants requires exposed wet surfaces, so sowing just after the first fall rains or irrigating may be optimal.

c) Soil Cores

Soil cores from nearby donor wetlands rich in native species diversity is suggested as an experimental technique for potentially recovering species no longer found at

a site such as Mirror Lake, as well as to enhance genetic diversity for species propagated by other means. Seeds, spores, shoots, and rhizomes may be captured by a given soil core. A standard soil corer can be used to obtain cores several inches in length from appropriate locales within a donor site. Careful documentation of all cores, including a sample number, GPS waypoint and environmental characteristics of the location within the donor site, should accompany each specimen. The cores can be taken to a nursery and placed in planting media and "grown" or may be placed directly in the wetland. All cores should be accompanied by labels that match the sample number. Metal stakes with embossed numbers are one option for labeling.

Table 11
Proposed Species List for Wet Meadows along Nordhoff Stream Channel

Species	Habit	Found at Ojai Meadows Preserve?
Brown-headed Rush (*Juncus phaeocephalus)*	Herbaceous perennial	Yes
Mexican Rush (*Juncus mexicanus*)	Herbaceous perennial	Yes
Indian Rush (*Juncus textilis*)	Herbaceous perennial	Not on site, but in Ojai area
California Bulrush (*Scirpus californicus*)	Herbaceous perennial	Yes
Common Spikerush (*Eleocharis macrostachya*)	Herbaceous perennial	Yes
Yellow Nutsedge (*Cyperus eragrostis*)	Herbaceous perennial	Yes
Meadow Barley (*Hordeum brachyantherum*)	Perennial grass	Yes
Western Goldenrod (*Euthamia occidentalis*)	Herbaceous perennial	Not on site, but in Ojai area

Table 12
Proposed Species List for Bioswales draining Nordhoff High School

Species	Habit	Found at Ojai Meadows Preserve?
Brown-headed Rush (*Juncus phaeocephalus)*	Herbaceous perennial	Yes
Mexican Rush (*Juncus mexicanus*)	Herbaceous perennial	Yes
Indian Rush (*Juncus textilis*)	Herbaceous perennial	Not on site, but in Ojai area
California Bulrush (*Scirpus californicus*)	Herbaceous perennial	Yes
Common Spikerush (*Eleocharis macrostachya*)	Herbaceous perennial	Yes
Yellow Nutsedge (*Cyperus eragrostis*)	Herbaceous perennial	Yes
Meadow Barley (*Hordeum brachyantherum*)	Perennial grass	Yes
California Wild Rose (Rosa californica)	Shrub	Not on site, but in Ojai area

Table 13
Proposed Species List for Seasonally Dry Wetland
Fed by runoff from Taormina Neighborhood

Species	Habit	Found at Ojai Meadows Preserve
Common Rush (*Juncus patens*)	Herbaceous perennial	Not on site, but in Ojai area
Mulefat (*Baccharis salicifolia*)	Shrub	Yes
California Wild Rose (*Rosa californica*)		Not on site, but in Ojai area
Other species to be determined once water retention capacity of this corridor is known		

d) Erosion control

Because wet meadow vegetation will occur on slopes next to wetland channels, slope stabilization will be an important component of wet meadow restoration. We recommend that the slopes by hydroseeded with a tactifier and wetland seed mix, as well as planted with container-grown and salvaged material. Use of coconut or jute netting on all plantings will be necessary. Netting should be secured with metal stakes placed every 9 to 12 inches.

Sediment barriers and/or water bars should be placed at regular intervals down slopes to divert large accumulations of sediment and/or water. These barriers should remain in place until the surface of the ground is revegetated with deep-rooted native plants. If necessary, they should be cleaned out or reformed prior to the completion of revegetation. See *Section VI.: Construction Guidelines* for more information.

5. Freshwater Marsh

Freshwater marsh species will become established in areas with permanently flooded soils, which include the centers of meandering channels originating from Nordhoff High School, as well as the Nordhoff stream channel and Happy Valley Drain. Judicious design of plantings will allow patches of freshwater marsh vegetation to proliferate without blocking streamflow during flooding.

A combination of transplanting, container-grown material, direct seeding, and use of excavated soil may be used for restoring freshwater marsh vegetation. It is strongly recommended that the bulk of the restoration material be planted from live material that is salvaged, transplanted or grown in containers in order to rapidly establish desired vegetation and inhibit weed establishment. Further, native Cattail (*Typha* species) tends to form monocultures in newly established wetlands unless a high density of plantings covers suitable habitat, 5,000 to 12,000 plants/acre according to Mitsch and Gosselink (2000).

Collection numbers and associated documentation, along with propagation logs should be maintained for all plant material (see Seed and Propagule Propagation section below).

a) Salvaging, Transplanting, and Container-grown Stock

Salvaging and transplanting emergent freshwater marsh species already in wetlands on the Preserve will be necessary in order to preserve the local genotypes during grading of drainages. Plants to be salvaged include:

- Water-plantain (*Alisma plantago-aquatica*)
- California Bulrush (*Scirpus californicus*)

- Yellow Nutsedge (*Cyperus eragrostis*)
- Southern Cattail (*Typha domingensis*)

Transplanting freshwater marsh species from nearby donor sites, such as Mirror Lake and Santa Ana wetland, is also recommended. Plants to be obtained from donor sites include:

- Water-plantain (*Alisma plantago-aquatica*)
- Yellow Nutsedge (*Cyperus eragrostis*)
- Common Spikerush (*Eleocharis macrostachya*)
- Montevideo Spikerush (*Eleocharis montevidensis*)
- Mexican Rush (*Juncus mexicanus*)
- California Loosestrife (*Lythrum californicum*)
- Dotted Smartweed (*Polygonum punctatum*)
- Pondweed (*Potamogeton* species)
- Sanford's Arrowhead (*Sagittaria sanfordii*)
- Rocky Mountain Bulrush (*Scirpus saximontanus*)

Rhizomes and/or whole plants of desired species can be dug and placed in large plastic bags or buckets. These should be transplanted at the Preserve within 36 hours. Those that cannot be planted soon after digging should be placed in containers and grown in a nursery.

The Restoration Manager may also elect to propagate some of these plants in a nursery in order to maximize the number of individual available for outplanting, especially those that occur in low numbers in the wild. In addition, some of these plants may not be readily available and may be grown in a nursery from seed or cuttings before being planted at the Preserve. At least one year should be allowed for growing many container-grown marsh plants to an appropriate size for outplanting.

b) Soil Cores:

Soil cores from nearby donor wetlands rich in native species diversity is suggested as an experimental technique for potentially recovering species no longer found at a site such as Mirror Lake, as well as to enhance genetic diversity for species propagated by other means. Seeds, spores, shoots, and rhizomes may be captured by a given soil core. A standard soil corer can be used to obtain cores several inches in length from appropriate locales within a donor site (for instance, the low point in a wetland, the least disturbed or weedy wet margins, etc.). Careful documentation of all cores, including a sample number, GPS waypoint and environmental characteristics of the location within the donor site, should accompany each specimen. The cores can be taken to a nursery and placed in planting media and "grown" or may be placed directly in the wetland. All cores

should be accompanied by labels that match the sample number. Metal stakes with embossed numbers are one option for labeling.

c) Seeding for Freshwater Marsh

A few freshwater marsh species may become established by judicious use of broadcast seeding. Plants that may become established in this manner include all of the afore-mentioned species plus Water-plantain (*Alisma plantago-aquatica*), Western Goldenrod (*Euthamia occidentalis*), and others. Seeds of these plants may be obtained from nearby donor wetlands such as Mirror Lake and Santa Ana wetland.

Planting of freshwater marsh species may be best accomplished in spring, as soil begins to dry out, and fall, prior to the onset of winter rains. Where possible, a distinction between seasonally flooded and continuously saturated soil should be determined and marked so that the Restoration Manager can spot the cores and planting materials according to tolerance of different water regimes.

Table 14
Proposed Species List for Freshwater Marsh along Nordhoff Stream Channel

Species	Habit	Found at Ojai Meadows Preserve?
California Bulrush (*Scirpus californicus*)	Herbaceous perennial	Yes
Common Spikerush (*Eleocharis macrostachya*)	Herbaceous perennial	Yes
Water-plantain (*Alisma plantago-aquatica*)	Herbaceous perennial	Yes
Sanford's Arrowhead (*Sagitarria sanfordii*)	Herbaceous perennial	Not on site, extirpated from Ojai area
Marsilea (*Marsilea vestita)*	Herbaceous perennial	Not on site, extirpated from Ojai area
American Pillwort (*Pilularia americana*)	Herbaceous perennial	Not on site, extirpated from Ojai area
Howell's Quillwort (*Isoetes howellii*)	Herbaceous perennial	Not on site, extirpated from Ojai area
California Waterwort (*Elatine californica*)	Annual	Not on site, extirpated from Ojai area
Others		

6. Irrigation

Irrigation is the single most important factor in the success of restoration plans in California because of the unpredictability of rainfall frequency and quantity; this is especially true for wetland vegetation. Adequate soil moisture allows plants to grow vigorously and compete effectively with weeds.

Seeding and planting will take place from September to November in order to take maximum advantage of seasonal precipitation. Additional watering will be accomplished by a wheeled, high powered overhead sprinkler. Wells at the Preserve could be used as a temporary water source with the use of portable pumps attached to the well head; the use of well water for initial irrigation is estimated to take place only during the first two years after planting and will depend on seasonal rainfall. If rains are not adequate, irrigation (of the entire site in stages) will need to happen as often as the Restoration Manager deems necessary before the end of April. The sprinkler should run for a 24 hour period in each location to adequately penetrate to the root zone. This areas needs to be kept consistently moist during germination. The Restoration Manager will make a determination as to whether summer watering will be needed. If so it will be carried out in the same way. Irrigation may not be necessary in the second season. The decision to irrigate will be made prior to the dormant season and will be based on results of plant establishment and cover.

D. Proposed Coast Live Oak Woodland

1. Location and Layout of Proposed Coast Live Oak Woodland

Coast Live Oak Woodland was probably abundant on the southern and western portions of the Preserve prior to mechanical clearing; dense Coast Live Oak Woodland is visible on Krotona Hill to the south and in Meiners Oaks to the west of the Preserve in the 1929 aerial photograph (Map 8). Degraded Coast Live Oak Woodland is still present in these locations today, and many young Coast Live Oak seedlings and saplings are found under the canopy of both native and exotic trees in the area.

We propose restoring 9.4 acres of Coast Live Oak Woodland north and west of Happy Valley Drain between the Drain and Meiners Oaks School, as well as south of the Happy Valley Drain to the west and into the *Eucalyptus* grove (Map 15). East of the *Eucalyptus* grove, we suggest planting scattered clumps of Coast Live Oak interspersed with native grassland. The savanna-like arrangement of Coast Live Oaks (12.3 acres) would allow residents to the south to retain views of the Meadow and mountains, while enjoying the profiles of beautiful oaks and seasonal displays of wildflowers.

2. Species Composition

The dominant species in a Coast Live Oak Woodland is, of course, Coast Live Oak (*Quercus agrifolia*). Associated tree species found in the Ojai area include California Black Walnut (*Juglans californica*), a rare hardwood tree endemic to southern California (CNPS list 4); California Bay (*Umbellularia californica*); and, in moister sites, Bigleaf Maple (*Acer macrophyllum*). The understory of pristine Coast Live Oak Woodland consists of large and small shrubs, patches of herbaceous perennials, and scattered ferns, lilies, and other perennial species.

Based on an examination of Coast Live Oak Woodland in the Ojai area, we have created a proposed species list for use in restoration of this diverse community.

Table 15
Proposed Species List for Coast Live Oak Woodland

Species	Habit	Abundance in Coast Live Oak Woodland	Found at Ojai Meadows Preserve?
Coast Live Oak (*Quercus agrifolia*)	Tree	Abundant, dominant	Yes
California Black Walnut (*Juglans californica*)	Tree	Occasional	Not on site, but in Ojai area
California Bay (*Umbellularia californica*)	Tree	Occasional	Not on site, but in Ojai area
Bigleaf Maple (*Acer macrophyllum*)	Tree	Occasional	Not on site, but in Ojai area
Toyon (*Heteromeles arbutifolia*)	Large shrub	Occasional	Yes
Mexican Elderberry (*Sambucus mexicana*)	Large shrub	Occasional	Yes
Holly-leaf Cherry (*Prunus ilicifolia*)	Large shrub	Occasional	Yes
Holly-leaf Coffeeberry (*Rhamnus ilicifolia*)	Large shrub	Occasional	Yes
Snowberry (*Symphoricarpos mollis*)	Creeping shrub	Common	Not on site, but in Ojai area
Currants and gooseberries (*Ribes* species)	Medium Shrub	Occasional	Not on site, but in Ojai area
California Blackberry (*Rubus ursinus*)	Woody vine	Common	Yes
Coastal Wood Fern (*Dryopteris arguta*)	Herbaceous perennial	Scattered	Not on site, but in Ojai area
Bracken Fern (*Pteridium aquilinum*)	Herbaceous perennial	Scattered	Not on site, but in Ojai area
Hummingbird Sage (*Salvia spathacea*)	Herbaceous perennial	Scattered	Not on site, but in Ojai area
Wood Mint (*Stachys bullata*)	Herbaceous perennial	Scattered	Not on site, but in Ojai area
Humboldt Lily (*Lilium humboldtii*)	Herbaceous perennial	Scattered	Not on site, but in Ojai area

3. Site Preparation

The initial phase of site preparation should focus on weed eradication prior to grading and/or planting. Herbicides are a possible method for exotic species treatment, however, it is not a recommended alternative at this stage due to environmental concerns and the proximity of schools. Methods for treating various exotic weeds are described in detail below.

a) Exotic species treatments

There are many non-native species found at Ojai Meadows Preserve in the area where restoration of Coast Live Oak Woodland is proposed (Map 14). In addition to widespread annual European grasses and mustards, which will be discussed below, there are twelve exotic weedy species in the proposed Coast Live Oak Woodland planting area that are designated by either the California Department of Food and Agriculture and/or the California Invasive Plant Council as Noxious Weeds. These should be suppressed and/or eradicated as an initial phase of site restoration.

The noxious weeds in the proposed Coast Live Oak Woodland area (excluding the widespread non-native grasses and mustards) include: Giant Reed (*Arundo donax*), Russian Knapweed (*Acroptilon repens*), Fennel (*Foeniculum vulgare*), Drummond's Gaura (*Gaura drummondii*), Kikuyu Grass (*Pennisetum clandestinum*), Castor Bean (*Ricinus communis*), Bristly Ox-tongue (*Picris echioides*), Italian Thistle (*Carduus pynocephalus*), Yellow Star Thistle (*Centaurea solstitialis*), Bull Thistle (*Cirsium vulgare*), Milk Thistle *(Silybum marianum*), and Curly Dock (*Rumex crispus*). In addition, Blue Gum (*Eucalyptus globulus*) is designated as a Noxious Weed and will be discussed in the section on the *Eucalyptus* grove. Treatments for each are described below.

In addition, there are a number of non-native planted shrubs and trees in this area. We recommended that all of these be removed (see below).

Giant Reed (*Arundo donax*): *Arundo donax* is a tall (15 – 25 feet) upright, perennial, cane-like, non-native grass with long strap-shaped leaves. It is extremely invasive in wetlands throughout the world. The creeping rootstocks (rhizomes) are fleshy, forming compact masses from which arise tough, fibrous roots that penetrate deeply into the soil. The plant rarely flowers in California, but easily spreads vegetatively.

Photo 55: Giant Reed at the Preserve *photograph by Mary Carroll*

There is one clump of Giant Reed on the Preserve at present. It is located northwest of Happy Valley Drain; there are several large clumps up the drain on Church property and private land. The *Arundo* can be cut with loppers to 18 " or less; all canes must be carefully bagged and removed. A backhoe can then be used to remove the remaining stems; this can also be done by hand. Either way, the work must be thorough to be effective, since each piece of root that breaks off can produce a new plant. All parts should be bagged and removed from the site. The plant is therefore not suitable for composting or dumping at the landfill.

Photo 56: Clumps of Giant Reed by the Happy Valley Drain Near the Church (offsite) *photograph by Mary Carroll*

In addition, a plan needs to be developed for control of the existing clumps of Giant Reed that are growing north of the Preserve along the Happy Valley Drain. These colonies will probably re-invade the restored Preserve over time, unless preventative action is taken. The Conservancy should initiate cooperative efforts to completely remove these small, but well established, colonies.

Follow-up treatments may be necessary in the year or two after eradication to remove any sprouts missed during the initial treatment (see Monitoring).

Russian Knapweed (*Acroptilon repens*): Russian Knapweed is an herbaceous perennial that forms large colonies by means of creeping stems. Stems as small as one inch can generate new shoots from a depth of 6 inches. Leaves form a rosette until the plant blooms in summer, producing hemispheric clusters of pink flowers on one to three foot stems. The plant produces toxins that are poisonous to livestock.

Photo 57: Russian Knapweed infestation at the Preserve *photograph by Mary Carroll*

Mechanical removal (digging, bulldozing) of plants encourages new shoots to sprout from

rhizomes, and shallow cultivation can sever roots and encourage spread of the colony. Although herbicides have been effective in eradicating Russian Knapweed, their use so close to an elementary school, coupled with public visitation to the Preserve, makes this option undesirable. Therefore, we suggest two alternatives.

Photo 58: Russian Knapweed in Bloom *courtesy of California Department of Food and Agriculture*

One is covering the entire patch plus a five-foot perimeter with clear plastic in order to solarize the Knapweed. The edges should be anchored with soil staples and then covered with soil. The plastic should be 1-2 millimeter thick. The plastic should be left in place for six to eight weeks and then lifted to see if the plants have been effectively killed. Leaving the plastic in place longer may cause the plastic to become brittle; it may need to be replaced if the plants are not yet dead.

Shading has been shown to be effective in eliminating Russian Knapweed, so another method is the use of overlapping cardboard mulch five feet beyond the edge of the colony in each direction and topped with wood chips. This area would then be taped off and sealed with staples. The cardboard should be left in place, where it will decompose.

Follow-up treatments may be necessary in the year or two after eradication to remove any sprouts missed during the initial treatment (see Monitoring).

The gathering of cardboard is an opportunity for an educational awareness raising activity in the local schools.

Fennel (*Foeniculum vulgare*): Fennel is an upright multi-stemmed herbaceous perennial with finely divided leaves that produce linear segments and a distinctive anise scent. Deep taproots anchor the plant in place and provide moisture in summer, when the plant produces profusions of tiny yellow flowers in star-shaped clusters ("umbels"). Prolific seed production enables the plants to rapidly invade disturbed areas, where it can replace much of the surrounding vegetation.

Only a few small clumps of Fennel are located at the Preserve. However, Fennel is highly invasive elsewhere in the state below 2000 feet. This makes immediate removal of this plant a high priority. The entire plant and all of its roots should be dug up and bagged anywhere it is encountered. Like the other perennial weeds, it can easily become established if small pieces of stem remain, so care should be taken to remove the entire plant.

Photo 59: Fennel Infestation (Santa Cruz Island) *photograph by Mary Carroll*

An ongoing policy of removing Fennel as soon as it is encountered should enable the Conservancy to prevent this weed from forming established large colonies (see Monitoring).

Drummond's Gaura (*Gaura drummondii*): Drummond's Gaura is a rhizomatous herbaceous perennial that can rapidly spread vegetatively and by seed. When flowering it produces stems from several inches to three feet in length with clusters of white to pink flowers; small fruits (1/4 to ½ inch) develop that widen abruptly from their bases.

Drummond's Gaura is only found at the base of the Nordhoff Drain just above the confluence with the Happy Valley Drain and appears to be spreading. It should be immediately removed before it spreads further. The entire plant and all of its rhizomes should be dug up and bagged anywhere it is encountered. Like the other perennial weeds, it can easily become established if small pieces of stem remain, so care should be taken to remove the entire plant.

An ongoing policy of removing Gaura as soon as it is encountered should enable the Conservancy to prevent this weed from forming established large colonies (see Monitoring).

Photo 60: Drummond's Gaura (*Gaura drummondii*) *courtesy of uvalde.tamu.edu*

Kikuyu Grass (*Pennisetum clandestinum*): Kikuyu Grass is a low-growing grass (to 2 feet) that spreads rapidly by rhizomes and runners. Small rhizome and stolon fragments readily generate new plants. Flowers are inconspicuous and are produced infrequently.

Photo 61: Kikuyu Grass (*Pennisetum clandestinum*) *courtesy of The Nature Conservancy*

Kikuyu Grass is presently found only near the water pipe originating from the Taormina neighborhood. The entire plant and all of its rhizomes, runners, and roots should be dug up and bagged anywhere it is encountered. Like the other perennial weeds, it can easily become established if small pieces of stem remain, so care should be taken to remove the entire plant. Consistent hand removal is the only feasible way to control this weed in this location.

An ongoing policy of removing Kikuyu Grass as soon as it is encountered should enable the Conservancy to prevent this weed from forming established large colonies (see Monitoring).

Castor Bean (*Ricinus communis*): Castor Bean is a rank shrub to small tree that can reach 15 feet in height in moist environments. It produces large (4 – 16 inch), palmate, lobed leaves and small flowers. Fruits are spiny and split open to reveal the elongate brown seeds (1/2 to 1 inch). Seeds are extremely toxic and are the source of castor oil as well as the bioterrorism agent 'ricin.' Just two seeds can kill a human, and its proximity to local schools is a matter of concern. Seeds are currently sold as a gopher deterrent (Bossard et al. 2001).

Photo 62: Castor Bean (*Ricinus communis*) *courtesy of The Nature Conservancy*

Castor Bean has a high moisture requirement and is restricted to a colony in the area east of the berm bordering the *Eucalyptus* grove at the Preserve. Elimination of the berm and directing the Taormina run-off into channels toward a larger delta near the proposed wetland will be a first step in controlling this infestation. Nonetheless, Castor Bean infestations may

become an ongoing problem in the restored wetland area without proper monitoring.

Castor Bean can be dug, bagged, and removed. Care should be taken to carefully dig up the entire plant and all roots, stems, fruits, and seeds. Protective gear or other sufficient precautions should be taken by those removing the weed so that no residue from the plant comes in contact with eyes, mouth or skin.

An ongoing policy of removing Castor Bean as soon as it is encountered should enable the Conservancy to prevent this weed from spreading (see Monitoring).

Bristly Ox-tongue (*Picris echioides*): Bristly Ox-tongue is a 4 to 5 foot tall biennial plant with tough foliage and yellow flowers. It thrives in moist areas and forms dense stands that exclude native vegetation. Seeds germinate and quickly grow into prostrate, basal rosettes. Yellow dandelion-like flowers appear throughout spring and summer, and seeds are wind dispersed.

Bristly Ox-tongue is found in many places at Ojai Meadows Preserve in clay and/or moist soils. It can be removed by hand and we recommend that this be done at least twice per year, during early winter and late spring. The entire plant can be pulled when the ground is wet and soft. Care should be taken to remove and flower heads before they set seed between treatments. Repeated removal efforts will be necessary to exhaust the seed bank, and consistent hand removal is the only feasible way to control this weed in this location.

Photo 63: Bristly Ox-tongue (*Picris echioides*) *courtesy of The Nature Conservancy*

The Thistles: Italian Thistle (*Carduus pynocephalus*), Milk Thistle (*Silybum marianum*), Yellow Star Thistle (*Centaurea solstitialis*), and Bull Thistle (*Cirsium vulgare*): There are four non-native annual to biennial thistle species at Ojai Meadows Preserve, in addition to their distant relatives the sow-thistles (*Sonchus* species). Because these four species have the potential to form large infestations, they are described here, along with a common treatment for the four of them at the end of the descriptions.

All four thistles are annuals to biennials that germinate with fall rains and form a rosette of leaves and later form elongate stems terminated by spiny heads of flowers that are followed by tufted, wind-dispersed seeds.

Photo 64: Italian thistle (*Carduus pycnocephalus*) *courtesy of The Nature Conservancy*

Italian thistle (*Carduus pycnocephalus*) reaches three feet or more in height when it blooms and is distinguished by its spiny wings along the stems, as well as its clusters of medium-sized (1/2 to 1 inch) heads of narrow spiny-tipped phyllaries and pinkish flowers. It produces prolific seeds that rapidly germinate; seeds can remain in the soil for up to eight years and still germinate (Brossard et al. 2001). Italian thistle is scattered throughout the Ojai Meadows Preserve, forming large infestations in places.

Milk Thistle (*Silybum marianum*) produces distinctive shiny, spiny green leaves with white mottled markings. The four to six foot tall stems lack spiny wings and the solitary flower heads are large, generally one to two inches across. Phyllaries surrounding the heads are elongate and spine-tipped, with spiny-toothed margins as well. Flowers are magenta. Each terminal head produces approximately 100 seeds; 10 to 50 heads are produced per plant. *Silybum* seed has the potential to remain viable in the soil for up to 9 years. Milk Thistle is present at the Preserve in small numbers. The colony shown in Photo XX was observed on Church property adjacent to Happy Valley Drain.

Photo 65: Milk Thistle *photograph by Mary Carroll*

Yellow Star-thistle (*Centaurea solstitialis*) produces rosettes of non-spiny, variously lobed leaves that are covered with fine cottony hairs. Roots can reach over 3 feet in depth to obtain moisture during the dry season. Stems can be one to four feet in height and are winged but non-spiny. The egg-shaped flower heads are ½ to one inch long and consist of phyllaries with sharp yellow spines ½ to one inch in length. Flowers are yellow and seeds can be tufted or not. Yellow Star Thistle is present at the Preserve in small numbers, but is considered one of the worst weeds in the state due to its invasive qualities.

Photo 66: Yellow Star-thistle (*Centaurea solstitialis*) *courtesy of California Department of Food and Agriculture*

Bull Thistle (*Cirsium vulgare*): Bull thistle is a coarse annual or biennial that reaches three to four feet in height at maturity. It has stiff, white-hairy foliage and conspicuous prickles along leaf margins and bases, which may make the stems appear winged. Its large flower-heads (1 – 2 inches) are spiny and produce purplish flowers. Only a few Bull Thistle are present at the Preserve.

Photo 67: Bull Thistle (*Cirsium vulgare*) *courtesy of California Department of Food and Agriculture*

Effective control of all thistles requires suppression of seed production over several years, as well as elimination of seeds from the seed bank. Hand-hoeing is effective for small patches, but care should be taken to sever the root at least four inches below ground level. All plants and plant parts should be bagged and removed. Removal at least three times a year is recommended, in winter, spring, and summer.

Curly Dock (*Rumex crispus*): Curly Dock is a leafy herbaceous perennial that grows up to 6-feet tall. Growing from an enlarged taproot, its stem is ribbed and reddens with age. Its rough and frilly-edged leaves grow from 5 to 20 inches long, often with

reddish spots. Seed clusters turn deep red-brown as they mature. This weed is highly invasive in grassland and wetland environments, outcompeting native plants for resources.

The entire plant and all of its roots should be dug up and bagged anywhere it is encountered. Consistent hand removal is the only feasible way to control this weed in this location.

An ongoing policy of removing Curly Dock as soon as it is encountered should enable the Conservancy to prevent this weed from spreading (see Monitoring).

Photo 68: Curly Dock at the Preserve *photograph by Mary Carroll*

b) Removal of some Eucalyptus trees

We recommend that approximately one-third to one-quarter of the *Eucalyptus* grove be removed in order to create a diverse riparian forest. The main area in which they would be removed is at the confluence of the Happy Valley and Nordhoff Drains as shown in Map 16. In addition, we propose *Eucalyptus* removal from the stream channels and adjacent banks wherever they occur in order to maximize slope stability and flood control, as well as biological diversity.

We propose to replace these trees with a large, tall riparian forest in order to enhance biological diversity. The number of Eucalyptus trees removed would be about 90, and they would be replaced by 120 tall native riparian trees. This native forest is expected to grow quickly and soon become a sanctuary for wildlife and people alike.

The remaining two-thirds to three-quarters of the Eucalyptus grove would remain intact for the present time. However, young seedlings and saplings will be removed periodically, in order to prevent the spread of the grove. The entire Eucalyptus grove will be reduced in size and phased out over time as trees decline and die. This area will eventually be replaced by native oak woodland habitat.

c) Removal of non-native plantings

The "Besant Meadows" portion of the Ojai Meadows Preserve is the site of a former building complex and associated plantings. Among the plantings in this area are Oleander (Nerium oleander), Italian Cypress (*Cupressus sempervirens*), English Walnut (*Juglans regia*), Pomegranate (*Punica granatum*), Fire-thorn (*Pyracantha angustifolia*), cultivated Rose (*Rosa* cultivar), Blue Agave (*Agave americana*), cultivated Hibiscus (*Hibuscus* cultivar) and two or three varieties of Elm (*Ulmus* species and/or cultivars). In addition there are scattered *Eucalyptus* in this area and a large *Melaleuca armillaris*, along with a few Bailey's Acacia (*Acacia baileyana*). Many native Coast Live Oak and Holly-leaf Cherry seedlings and saplings have germinated under the canopy of these plantings.

Non-native trees are also scattered along the southern fence line of the "Palmer Property," mixed with native oak seedlings and saplings as well. These include Aleppo Pine (*Pinus halapensis*), Peruvian Pepper Tree (*Schinus molle*), and others.

All non-native trees and shrubs in the proposed Coast Live Oak Woodland area outside the main *Eucalyptus* grove should be removed. Removal of the non-native plantings can be phased with the planting of restoration species, as several of these non-native species are not considered invasive. However, it may be desirable to first remove invasive trees and trees that shelter native tree seedlings and saplings under their canopies in order to maximize the growth of the native trees. A tree removal service should be hired to handle the removal of trunks, stems, and roots, along with removal of all flowering and fruiting parts. All native Coast Live Oak and Holly-leaf Cherry seedlings, saplings, and trees should be flagged and protected during the removal of the non-native vegetation. The Restoration Manager should be present throughout this process to ensure the survival of the native plants and the removal of the non-native trees and shrubs.

d) Non-native annual European grasses and mustards

Competition and interference by non-native grasses and mustards is one of the biggest contributors to restoration plan failure. Many California native plants are slow-growing and easily overwhelmed by the number and vigor of non-native weeds. Studies show that native plants do best when weeds are controlled prior to restoration (Stromberg and Kephart 1996).

One of the most optimal means of reducing cover by introduced weedy grasses and mustards is through the safe and judicious use of controlled burns. When coordinated with knowledgeable local fire officials, controlled burns can be a safe, effective management practice. With cooperation from the Ventura County Fire Department, we propose that most of the areas on the Preserve intended for grassland or wetland restoration be successively burned, preferably in year 1 of

the restoration project. This controlled burn would be similar to the regular supervised burning of non-productive citrus orchards that takes place in the Valley.

The County Fire Department has previously requested permission from the Conservancy to conduct a prescribed burn on the Preserve. The Conservancy was and remains receptive to the idea of a controlled burn, provided that adequate fire fighting equipment and staff are onsite, that the Department accept liability for the entire process, and that adequate time (minimum of one month) is given for the Conservancy to make community members aware of the plan and understand the reasons why it is being conducted (Jim Jackson and Jim Engel, *pers. comm*.)

Prior to burning, several steps should be completed. Seed collection from existing native plants on the Preserve should be scheduled prior to burning; the controlled burn should not be scheduled until the Restoration Manager asserts that all desirable seed has been collected. Introduced woody shrubs and trees slated for removal should be taken out to minimize fuel build-up, especially *Eucalyptus* outside of the main grove. All existing native trees, shrubs and seedlings should be marked and avoided during the burn; control of weedy plants and grasses within these barriers should be done by hand. Educational outreach on the benefits of controlled burns to neighbors and community members should also be carefully coordinated. In addition, some weeds respond favorably to burning and should be eliminated or significantly reduced prior to burning.

Another option for reducing European grasses and mustards has been reported from researchers at the University of California Hastings Reservation in Monterey County. They suggest the following method:

> "Till the soil over a long enough period of time to exhaust the seed bank. You till and kill seedlings before they make seeds, then till again to kill the next crop of seeds in the soil. Eventually (2-3 years, with 3-4 tillages cycles each year) the number of seeds in the soil's "bank" of seeds is exhausted.
>
> Start in the fall, after the first rains have delivered a few inches of moisture. Based on techniques discovered in the earliest days of agriculture, one can use a disk to turn over the top layer of soil and bury the existing vegetation… As winter storms later arrive to wet the soil, the soil microbes attack the buried vegetation and break it down into a colloid of nutrients that is quickly bound up on soil particles and surfaces. Continue to uproot seedlings from the surface of the soil (hoes, spring tooth harrow, chain harrow, etc.) each time the seeds in the soils germinate and start to convert the nutrients to living tissue. If tilled before they can set any seed, they die and are returned to organic molecules (nutrients) in the soil.

> This process can be repeated 5-6 times over a winter. Each time a fine carpet of green seedlings emerges and are harrowed under, there are fewer weeds germinating. If one plows or discs deeply, this will only bring up the deeply buried seeds and increase the weed crop. Deep tilling should only be done once at the beginning of the project. If there is an extensive seed bank in the soil, it may take two winters of repeated harrowing after germination to clear the weeds from the top few inches of soil. Such repeated tillage also eliminates the gopher population from the patch, and gophers can be a major reason why native grass restoration projects fail" (Stromberg and Kephart 1996).

As with a controlled burn, all existing native trees, shrubs and seedlings should be marked and barriers to the tractor erected three feet beyond the canopies; control of weedy plants and grasses within these barriers should be done by hand.

If burning becomes an unworkable option some modification of the above approach would be possible. For instance, a weedy area can be mown before seed set. All existing native trees and any found seedlings should be marked and a barrier to the tractor erected three feet beyond the canopy. Control of weedy plants and grasses within this barrier should be done by hand.

4. Planting Plan for Coast Live Oak Woodland:

a) Species, Number of Plants and Propagation Method

Dense plantings characteristic of natural Coast Live Oak Woodland are proposed north and west of the Happy Valley Drain between the Drain and the Meiners Oaks School, as well as south of the Happy Valley Drain to the west and into the *Eucalyptus* grove, for a total of 9.4 acres. The perimeter of this planting should be laid out by the Restoration Manager using stakes or color coded flags.

East of the *Eucalyptus* grove, we suggest that scattered clumps of Coast Live Oak interspersed with native grassland be planted over 12.3 acres. Exact locations of oak clusters and grasslands will be similarly marked with stakes and/or flags by the restoration manager. We recommend that a combination of container grown plants and seed mixes be used for Coast Live Oak Woodland. Locally collected (on the Preserve or nearby Ojai Valley) plant material should be emphasized to preserve the genetic integrity of native plants at this site. A qualified horticulturist, botanist, or seed specialist should be contracted to collect seed and other propagules specified in this plan, preferably during summer. No substitutions will be allowed unless approved by the Restoration Manager. Documentation of seed collection, noting location, timing, and plant condition should be performed; records should be made available to the Site Monitor upon request or at least annually during the restoration project.

In addition a number of native Coast Live Oak and Holly-leaf Cherry seedlings, saplings, and trees are already growing in these areas and should be flagged and tagged during the restoration process. Each of the oaks have been given a number, a GPS point, and measured (height, diameter at breast height). Additional data may be gathered by the Restoration Manager to monitor the ongoing growth of these trees in comparison with the planted population.

Table 16
Planting Plan for 9.4 acres of *Dense* Coast Live Oak Woodland

Species	Total Plants	Propagation
Coast Live Oak (*Quercus agrifolia*)	**700 to survive; 900 planted**	Acorns, container
California Black Walnut (*Juglans californica*)	**30**	Container
California Bay (*Umbellularia californica*)	**40**	Container
Bigleaf Maple (*Acer macrophyllum*)	**15**	Container
Toyon (*Heteromeles arbutifolia*)	**300**	Container
Mexican Elderberry (*Sambucus mexicana*)	**500**	Container
Holly-leaf Cherry (*Prunus ilicifolia*)	**150**	Container
Holly-leaf Coffeeberry (*Rhamnus ilicifolia*)	**400**	Container
Snowberry (*Symphoricarpos mollis*)	**900**	Container
Currants and gooseberries (*Ribes* species)	**900**	Container
California Blackberry (*Rubus ursinus*)	**40**	Container
Coastal Wood Fern (*Dryopteris arguta*)	**900**	Container
Bracken Fern (*Pteridium aquilinum*)	**400**	Container
Hummingbird Sage (*Salvia spathacea*)	**1,500**	Container
Wood Mint (*Stachys bullata*)	**1,500**	Container
Humboldt Lily (*Lilium humboldtii*)	**140**	Container
Canyon Sunflower (Venegasia carpesioides)	**400**	Container
California Figwort (Scrophularia californica)	**400**	Container

Table 17
Planting Plan for 12.3 acres of *Scattered* Coast Live Oak Woodland

Species	Total Plants	Propagation
Coast Live Oak (*Quercus agrifolia*)	**250**	Acorns
California Black Walnut (*Juglans californica*)	**20**	Container
California Bay (*Umbellularia californica*)	**25**	Container
Bigleaf Maple (*Acer macrophyllum*)	**5**	Container
Toyon (*Heteromeles arbutifolia*)	**15**	Container
Mexican Elderberry (*Sambucus mexicana*)	**30**	Container
Holly-leaf Cherry (*Prunus ilicifolia*)	**10**	Container
Holly-leaf Coffeeberry (*Rhamnus ilicifolia*)	**5**	Container
Snowberry (*Symphoricarpos mollis*)	**30**	Container
Currants and gooseberries (*Ribes* species)	**40**	Container
California Blackberry (*Rubus ursinus*)	**5**	Container
Coastal Wood Fern (*Dryopteris arguta*)	**40**	Container
Bracken Fern (*Pteridium aquilinum*)	**70**	Container
Hummingbird Sage (*Salvia spathacea*)	**120**	Container
Wood Mint = (*Stachys bullata*)	**120**	Container
Humboldt Lily (*Lilium humboldtii*)	**100**	Container
Canyon Sunflower (*Venegasia carpesioides*)	**50**	Container
California Figwort *(Scrophularia californica*)	**40**	Container
Native Grassland Mix (see Native Grassland section)		

b) Planting of Container-Grown Plants

Container-grown plants should be laid out in irregular and naturalistic groupings by the Restoration Manager. All plantings should take place in autumn after grading and weed eradication efforts are deemed successful.

(1) Coast Live Oak

Holes should be dug to a depth of 18 inches and a width of 8 to 10 inches for planting container-grown oak seedlings. A cylindrical gopher cage made of one-half inch chicken wire should be placed in the hole. This cage should have no bottom and be 19 inches high and 8 to 10 inches wide. Prior to placing a young Coast Live Oak into a planting hole, a handful of soil taken from beneath a healthy natural Coast Live Oak may be placed in the bottom of the hole in which the

seedling will be planted. This added soil will provide the oak seedling, an obligate mycorrhizal species, with inoculum that may help it to survive.

A separate fencing protector should be constructed of one-half inch chicken wire. It should be 8 to 10 inches wide and two feet tall with a closed top if deer or ground squirrels are a problem. The upper cage will overlap the gopher cage already installed and be attached to a tree stake for support. Shade cloth may be utilized if seedlings appear to need shade; this will be determined by the Restoration Manager. Once the oak seedling has been prepared, the seedling should be deeply watered. Each oak will be marked with a numbered tag that references information on seed source, propagation, time of planting and other pertinent information. This information will provide valuable clues should there be uneven patterns of success or failure.

(2) Associated species

Once the Coast Live Oak population is laid out, associated species may also be planted using similar procedures (inoculation, gopher protection, deep watering). These species should also be marked with numbered tags.

c) Seed mix for associated Native Grassland

We propose the use of two different seed mixes for Coast Live Oak Woodland. **Coast Live Oak Erosion Control Seed Mix** will be hydroseeded over the entire designated area to provide soil stabilization and weed suppression (Map 18). This should be done in the fall of the first year after site preparation, between September and November.

Coast Live Oak Shade Seed Mix will be broadcast by hand under and on the north sides of planted Coast Live Oak clusters as well as under the canopies of existing trees in the area (Map 18). This should be done in the fall of the second year after planting of perennials, between September and November.

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Map 18: Seed Mixes

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Hydroseeding seed mixtures will be applied in a flexible growth medium and incorporate the specified seed mix and appropriate fertilizer, mycorrhizae inoculum, and a soil conditioner or humate. Final application rates will be agreed upon between the Restoration Manager and the seeding contractor. Work will be conducted by a reputable hydroseed contractor who will be required to hydroseed using the seed mix and application rate specified in this plan.

To avoid accidental introduction of non-native weeds during the hydroseeding process, the hydroseed contractor will be required to rinse the tank and all hoses and nozzles prior to arrival at the site. The Restoration Manager must be present to authenticate that the appropriate seed mix is used. Seed bag tags will be submitted to the Restoration Manager for verification. Unless authorized by the Restoration Manager, the seed mixture will not be added to the hydromulch in the tank until approval has been given and the hydroseed contractor is ready to apply the mixture.

Table 18
Coast Live Oak Erosion Control Seed Mix
(*application rates courtesy of S and S Seeds*)

Species	Percentage of seed mix	Seed application rate (pounds/acre)
Needle-grass (*Nassella* species)	30%	10
Small-flowered Melic (*Melica imperfecta*)	10%	2
Native Fescues (*Festuca* and *Vulpia*)	10%	4
California Brome (*Bromus carinatus*)	20%	6
California Poppy *(Eschscholzia californica)*	15%	3
Bicolored Lupine *(*Lupinus bicolor)	10%	4
Blue-eyed grass *(Sisyrinchium bellum)*	5%	2

Table 19
Coast Live Oak Shade Seed Mix
(*application rates courtesy of S and S Seeds*)

Species	Percentage of seed mix	Seed application rate (pounds/acre)
Needle-grass (*Nassella* species)	10%	6
Fiesta Flower (*Pholistoma auritum*)	5%	1
Baby Blue-eyes (*Nemophila menziesii*)	10%	2
Chinese Houses (*Collinsia heterophylla*)	15%	2
Blue-eyed grass *(Sisyrinchium bellum)*	15%	4
California Buttercup *(Ranunculus californicus)*	10%	1
Hummingbird Sage (*Salvia spathacea*)	15%	1
Wood Mint (*Stachys bullata*)	15%	2
Meadow-rue (*Thalictrum fendleri*)	5%	1

All seeded areas should be irrigated after sowing. Because of the number of wildflowers in the mix, these areas should be staked with streamers or pinwheels to discourage birds scratching newly sprouting seedlings. Construction and installation of these bird deterrents is another opportunity for community education and involvement, especially of school age children.

d) Irrigation

Irrigation is the single most important factor in the success of restoration plans in California because of the unpredictability of rainfall frequency and quantity. Adequate soil moisture allows plants to grow vigorously and compete effectively with weeds.

Seeding and planting will take place from September to November in order to take maximum advantage of seasonal precipitation. Additional watering will be accomplished with a wheeled, high powered overhead sprinkler. A well on the property can be used as a water source with the use of portable pumps attached to the well head. If rains are not adequate, irrigation (of the entire site in stages) will need to happen as often as the Restoration Manager deems necessary before the end of April. The sprinkler should run for a 24 hour period in each location to adequately penetrate to the root zone. The Restoration Manager will make a determination as to whether summer watering will be needed. If so it will be carried out in the same way. Irrigation may not be necessary in the second season. The decision to irrigate will be made prior to the dormant season and will be based on results of plant establishment and cover.

E. Proposed Valley Oak Savanna

1. Location and Layout of Valley Oak Savanna

Valley Oak Savanna and mixed oak stands of Valley Oak and Coast Live Oak were present on the northern portion of Ojai Meadows Preserve in the past, especially near water courses and in places with a high water table but adequate drainage.

We propose restoring 22.6 acres of Valley Oak Savanna across the northern portion of the Preserve on either side of the Nordhoff Drain. Several large Valley Oaks are present in this area east of the Nordhoff Drain, although two have died and at least two more are declining. All of the large trees need to be evaluated by a certified arborist to determine if they can be resuscitated and to ensure that they are properly pruned for safety reasons since they are shedding huge limbs. Where it can be done safely, dead trees should be left standing as snags and roosting sites for wildlife.

Nearby, on a raised berm adjacent to the Nordhoff Drain, over 120 Valley Oak seedlings and saplings have become established. Their establishment two feet above nearby large oaks suggests that the combination of height above standing water in winter months, coupled with proximity to water during summer provides optimal conditions for seedling establishment and growth. Further, this portion of the property is underlain with Sorrento clay soils, and shows little gopher activity, unlike the sandy clay loam soils closer to Krotona Hill. This population should be carefully fenced off, maintained, and monitored throughout the restoration project and beyond. Special precautions for avoiding this population during grading are outlined in the construction guidelines section.

Attempts to preserve the remaining large Valley Oaks as well as to protect and expand the small population of Valley Oak seedlings and saplings will receive first priority during restoration. Removal of the berm along the Nordhoff Drain except where the young Valley Oaks have become established is also recommended to allow water to drain away from, rather than pool around tree bases (See grading plan.). Young Valley Oaks have also been planted along the northern perimeter of the Preserve adjacent to Highway 33 and the St. Aquinas Church; these seem to be doing well and should be left in place. In this area, we propose creating a more natural-looking savanna of scattered Valley Oaks interspersed with native grassland.

2. Species composition

Valley Oak Savanna is dominated by Valley Oak (*Quercus lobata*) in the Ojai area, with some Coast Live Oak scattered with the Valley Oaks, especially away from drainage channels. Under the canopy of Valley Oaks a variety of annual wildflowers often occur, including Baby Blue Eyes (*Nemophila menziesii*) and Fiesta

Flower (*Pholistoma auritum*). Native perennial bunchgrasses, annual grasses and wildflowers would have been abundant between the oaks in the past, and we propose a recreation of this habitat at the Preserve, the first of its kind in the Ojai Valley.

Table 20
Proposed Species List for Valley Oak Savanna

Species	Habit	Abundance in Valley Oak Savanna	Found at Ojai Meadows Preserve?
Valley Oak (*Quercus lobata*)	Tree	Scattered, dominant	Yes
Coast Live Oak (*Quercus agrifolia*)	Tree	Common on well-drained soils	Yes
Mexican Elderberry (*Sambucus mexicana*)	Large shrub	Occasional	Yes
Gooseberry and Currant (*Ribes* species)	Shrub	Occasional	Not on site, but in Ojai area
Honeysuckle (*Lonicera* species)	Shrub	Occasional	Not on site, but in Ojai area
Needle-grass (*Nassella* species)	Perennial bunchgrass	Common between trees	Not on site, but in Ojai area
One-sided Bluegrass (*Poa secunda*)	Perennial bunchgrass	Scattered	Not on site, but in Ojai area
Delicate Bluegrass (Poa tenerrima)	Perennial bunchgrass	Uncommon	Collected on Black Mountain above Ojai
Small-flowered Melic (*Melica imperfecta*)	Perennial bunchgrass	Scattered	Not on site, but in Ojai area
California Blackberry (*Rubus ursinus*)	Woody vine	Common	Yes
Bracken Fern (*Pteridium aquilinum*)	Herbaceous perennial	Scattered	Not on site, but in Ojai area
Fiesta Flower (*Pholistoma auritum*)	Annual	Common under canopy of oak trees	Not on site, but in Ojai area
Baby Blue-eyes (*Nemophila menziesii*)	Annual	Common under canopy of oak trees	Not on site, but in Ojai area
Chinese Houses (*Collinsia heterophylla*)	Annual	Common under canopy of oak trees	Not on site, but in Ojai area
Blue-eyed grass *(Sisyrinchium bellum)*	Herbaceous perennial	Scattered	Not on site, but in Ojai area
California Buttercup *(Ranunculus californicus)*	Herbaceous perennial	Scattered	Not on site, but in Ojai area
Native Grassland Mix (see Native Grassland section)			

3. Site preparation

The initial phase of site preparation of the Valley Oak Savanna restoration area should focus on weed eradication prior to grading and/or planting. Herbicides are a possible method for exotic species treatment, however, it is not a recommended alternative at this stage due to environmental concerns and the proximity of schools. Methods for treating various exotic weeds are described in detail below.

a) Exotic species treatments

There are a number of non-native species found at Ojai Meadows Preserve in the area where restoration of Valley Oak Savanna is proposed (See Map 18). In addition to widespread annual European grasses and mustards, which will be discussed below, there are eight exotic weedy species in the proposed Valley Oak Savanna planting area that are designated by either the California Department of Food and Agriculture and/or the California Invasive Plant Council as Noxious Weeds. These should be suppressed and/or eradicated as an initial phase of site restoration.

The noxious weeds in the proposed Valley Oak Savanna area (excluding the widespread non-native grasses and mustards) include: Field Bindweed (*Convolvulus arvensis*), Bermuda-grass (*Cynodon dactylon*), Hyssop Loosestrife (*Lythrum hyssopifollium*), Bristly Ox-tongue (*Picris echioides*), Italian Thistle (*Carduus pynocephalus*), Yellow Star Thistle (*Centaurea solstitialis*), Milk Thistle *(Silybum marianum*), and Curly Dock (*Rumex crispus*). In addition, Blue Gum (*Eucalyptus globulus*) is designated as a Noxious Weed and will be discussed in the section on the *Eucalyptus* grove. Treatments for each are described below.

In addition, there are a few non-native planted trees in this area. We recommended that all of these be removed (see below).

Field Bindweed (*Convolvulus arvensis*): Field Bindweed is a viny herbaceous perennial with well developed roots and rhizomes. It forms large colonies and is considered an agricultural pest throughout the temperate world. Twining stems and distinctive arrow-shaped leaves with flaring bases are diagnostic, along with one-inch long white funnel-shaped ("morning-glory") flowers. Field Bindweed reproduces both by seed and vegetatively.

Photo 69: Field Bindweed (Convolvulus arvensis) *courtesy of California Department of Food and Agriculture*

Field Bindweed is found occasionally in the grasslands of Ojai Meadows Preserve. Field Bindweed is known to inhibit restoration efforts throughout the state, so every effort to eradicate it must be made. Although the best method may be to carefully dig, remove, and bag all parts, this must be done repeatedly since it continues to regrow from missed pieces of stem in the soil. Eradication often takes years. Due to its rapid growth rate, it is recommended that sites containing Field Bindweed be visited every two weeks and all parts removed.

Bermuda-grass (*Cynodon dactylon*): Bermuda Grass is a sod-forming perennial grass that can easily spread by both runners on top of the ground and rhizomes beneath. Like many of the tenacious perennial weeds at the site, small segments of these rhizomes can easily sprout to produce new plants. Small, alternating linear leaves and branches emanating from the center of the flower stalk (peduncle) are distinctive features of this grass.

Photo 70: Bermuda-grass (*Cynodon dactylon*) *courtesy of California Department of Food and Agriculture*

Bermuda Grass is found along the footpath from Nordhoff High School to Nordhoff Drain in moist soils, and may be scattered elsewhere on the Preserve. Persistent hand removal of rhizomes and stolons can eliminate Bermuda Grass from small areas. Summer solarization in moist soil for 6 weeks can also control infestations.

An ongoing policy of removing Bermuda Grass as soon as it is encountered should enable the Preserve to prevent this weed from spreading (see Monitoring).

Hyssop Loosestrife (*Lythrum hyssopifollium*): Hyssop Loosestrife is a low-growing summer-blooming annual or biennial. It is especially common in moist soils and is used as a wetland indicator species, but it is a weed. The angled stems bear smooth-margined leaves, and small lavender flowers are produced in the leaf

axils. The distinctive capsules (1/4 inch) are cylindrical in shape, with longitudinal ridges.

Hyssop Loosestrife is abundant in moist soils throughout the Preserve. An average of 3,200 seeds is produced by each plant. It is very difficult to control. Mowing is generally ineffective, although mowing timed at the bud stage may reduce seed production. Cutting earlier may increase stem densities and mowing after seed production only serves to spread the infestation. Hand pulling or digging results in more disturbance, but may be successful on small infestations. Young plants are most easily pulled, while older plants may require digging. New plants may emerge from missed roots or from stems left lying in contact with moist soil. Chemical treatments are sometimes the only way this plant is controlled.

Photo 71: Hyssop Loosestrife (*Lythrum hyssopifollium*)*courtesy of California Department of Food and Agriculture*

We recommend that hand pulling of Loosestrife take place every three months during the growing season, and that all parts be bagged and removed.

An ongoing policy of removing Hyssop Loosestrife as soon as it is encountered should be attempted to reduce infestations by this weed (see Monitoring).

Bristly Ox-tongue (*Picris echioides*): Bristly oxtongue is a 4 to 5 foot tall biennual plant with tough foliage and yellow flowers. It thrives in moist areas and forms dense stands that exclude native vegetation. Seeds germinate and quickly grow into prostrate, basal rosettes. Yellow dandelion-like flowers appear throughout spring and summer, and seeds are wind dispersed.

Bristly Ox-tongue is found in many places at Ojai Meadows Preserve in clay and/or moist soils. It can be removed by hand and we recommend that this be done at least twice per year, during early winter and late spring. The entire plant can be pulled when the ground is wet and soft. Care should be taken to remove flower heads before they set seed between treatments. Repeated removal efforts will be necessary to exhaust the seed bank.

The Thistles: Italian Thistle (*Carduus pynocephalus*), Milk Thistle (*Silybum marianum*), Yellow Star Thistle (*Centaurea solstitialis*), and Bull Thistle (*Cirsium vulgare*): There are four non-native annual to biennial thistle species at Ojai Meadows Preserve, in addition to their distant relatives the sow-thistles (*Sonchus* species). Because these four species have the potential to form large infestations, they are described here, along with a common treatment for the four of them at the end of the descriptions.

All four thistles are annuals to biennials that germinate with fall rains and form a rosette of leaves and later form elongate stems terminated by spiny heads of flowers that are followed by tufted, wind-dispersed seeds.

Italian thistle (*Carduus pycnocephalus*) reaches three feet or more in height when it blooms and is distinguished by its spiny wings along the stems, as well as its clusters of medium-sized (1/2 to 1 inch) heads of narrow spiny-tipped phyllaries and pinkish flowers. It produces prolific seeds that rapidly germinate; seeds can remain in the soil for up to eight years and still germinate (Brossard et al. 2001). Italian thistle is scattered throughout the Ojai Meadows Preserve.

Milk Thistle (*Silybum marianum*) produces distinctive shiny, spiny green leaves with white mottled markings. The four to six foot tall stems lack spiny wings and the solitary flower heads are large, generally one to two inches across. Phyllaries surrounding the heads are elongate and spine-tipped, with spiny-toothed margins as well. Flowers are magenta. Each terminal head produces approximately 100 seeds; 10 to 50 heads are produced per plant. *Silybum* seed has the potential to remain viable in the soil for up to 9 years. Milk Thistle is present at the Preserve in small numbers.

Yellow Star-thistle (*Centaurea solstitialis*) produces rosettes of non-spiny, variously lobed leaves that are covered with fine cottony hairs. Roots can reach over 3 feet in depth to obtain moisture during the dry season. Stems can be one to four feet in height and are winged but non-spiny. The egg-shaped flower heads are ½ to one inch long and consist of phyllaries with sharp yellow spines ½ to one inch in length. Flowers are yellow and seeds can be tufted or not. Yellow Star Thistle is present at the Preserve in small numbers, but is considered one of the worst weeds in the state due to its invasive qualities.

Bull Thistle (*Cirsium vulgare*): Bull thistle is a coarse annual or biennial that reaches three to four feet in height at maturity. It has stiff, white-hairy foliage and conspicuous prickles along leaf margins and bases, which may make the stems appear winged. Its large flower-heads (1 – 2 inches) are spiny and produce purplish flowers. Only a few Bull Thistle are present at the Preserve.

Effective control of all thistles requires suppression of seed production over several years, as well as elimination of seeds from the seed bank. Hand-hoeing is effective for small patches, but care should be taken to sever the root at least four inches below ground level. All plants and plant parts should be bagged and removed. Removal at least three times a year is recommended, in winter, spring, and summer.

Curly Dock (*Rumex crispus*): Curly Dock is a leafy herbaceous perennial that grows up to 6-feet tall. Growing from an enlarged taproot, its stem is ribbed and reddens with age. Its rough and frilly-edged leaves grow from 5 to 20 inches long, often with reddish spots. Seed clusters turn deep red-brown as they mature. This weed is highly invasive in grassland and wetland environments, outcompeting native plants for resources.

The entire plant and all of its roots should be dug up and bagged anywhere it is encountered. An ongoing policy of removing Curly Dock as soon as it is encountered should enable the Preserve to prevent this weed from spreading (see Monitoring).

Non-native annual European grasses and mustards: (see treatment described for Coast Live Oak Woodland).

4. Grading changes

All plans for grading in the proposed Valley Oak Savanna restoration areas are associated with creation and enhancement of wetlands and are discussed in that section.

5. Planting Plan for Valley Oak Savanna

a) Species, Number of Plants and Propagation Method

We propose restoring Valley Oak Savanna, interspersed with Native Grassland, across the northern portion of the Preserve on either side of the Nordhoff Drain. The perimeter of this planting should be laid out by the Restoration Manager using stakes or color coded flags. Exact locations of oak clusters and grasslands will be similarly marked with stakes and/or flags by the Restoration Manager.

In addition native Valley Oak, saplings, and trees already growing in these areas should be flagged and tagged during the restoration process. Each of the oaks have been given a number, a GPS point, and measured (height, diameter at breast height). Additional data may be gathered by the Restoration Manager to monitor the ongoing growth of these trees in comparison with the planted population.

We recommend that a combination of container grown plants and seed mixes be used for Valley Oak Savanna. Locally collected (on the Preserve or nearby Ojai Valley) plant material should be emphasized to preserve the genetic integrity of native plants at this site. A qualified horticulturist, botanist, or seed specialist should be contracted to collect seed and other propagules specified in this plan (preferably during summer). No substitutions will be allowed unless approved by the Restoration Manager. Documentation of seed collection, noting location, timing, and plant condition should be performed; records should be made

available to the Site Monitor upon request or at least annually during the restoration project.

Table 21
Planting Plan for 22.6 acres of Valley Oak Savanna

Species	Total Plants	Propagation
Valley Oak (*Quercus lobata*)	200	Acorns, container
Coast Live Oak (*Quercus agrifolia*)	20	Acorns, container
Mexican Elderberry (*Sambucus mexicana*)	30	Container
Gooseberry and Currant (*Ribes* species)	45	Container
Honeysuckle (*Lonicera* species)	45	Container
California Blackberry (*Rubus ursinus*)	10	Container
Bracken Fern (*Pteridium aquilinum*)	80	Container

b) Planting of container-grown plants:

Container-grown plants should be laid out in irregular and naturalistic groupings by the Restoration Manager. All plantings should take place in autumn after grading and weed eradication efforts are deemed successful.

(1) Valley Oak

Holes should be dug to a depth of 18 inches and a width of 8 to 10 inches for planting container-grown oak seedlings. A cylindrical gopher cage made of one-half inch chicken wire should be placed in the hole. This cage should have no bottom and be 19 inches high and 8 to 10 inches wide. Prior to placing a young Valley Oak into a planting hole, a handful of soil taken from beneath a *healthy* natural Valley Oak may be placed in the bottom of the hole in which the seedling will be planted. This added soil will provide the oak seedling, an obligate mycorrhizal species, with inoculum that may help it to survive.

A separate fencing protector should be constructed of one-half inch chicken wire. It should be 8 to 10 inches wide and two feet tall with a closed top if deer or ground squirrels are a problem. The upper cage will overlap the gopher cage already installed and be attached to a tree stake for support. Shade cloth may be utilized if seedlings appear to need shade; this will be determined by the Restoration Manager. Once the oak seedling has been prepared, the seedling should be deeply watered. Each oak will be marked with a numbered tag that references information on seed source, propagation, time of planting and other pertinent information. This information will provide valuable clues should there be uneven patterns of success or failure.

(2) Associated species

Once the Valley Oak population is laid out, associated species may also be planted using similar procedures (inoculation, gopher protection, deep watering). These species should also be marked with numbered tags.

c) Broadcast seed mix for associated Native Grassland

We propose the use of three different seed mixes for Valley Oak Savanna. **Valley Oak Erosion Control Seed Mix** will be hydroseeded over the entire designated area to provided soil stabilization and weed suppression (See Map 18). This should be done in the fall of the first year of planting between September and November.

Valley Oak Shade Seed Mix will be broadcast by hand under and on the north sides of planted Valley Oak clusters as well as under the canopies of existing trees in the area (See Map 18). This should be done in the fall of the second year after planting of perennials, between September and November.

Hydroseeding seed mixtures will be applied in a flexible growth medium and incorporate the specified seed mix and appropriate fertilizer, mycorrhizae inoculum, and a soil conditioner or humate. Final application rates will be agreed upon between the Restoration Manager and the seeding contractor. Work will be conducted by a reputable hydroseed contractor who will be required to hydroseed using the seed mix and application rate specified in this plan.

To avoid accidental introduction of non-native weeds during the hydroseeding process, the hydroseed contractor will be required to rinse the tank and all hoses and nozzles prior to arrival at the site. The Restoration Manager must be present to verify that the appropriate seed mix is used. Seed bag tags will be submitted to the Restoration Manager for verification. Unless authorized by the Restoration Manager, the seed mixture will not be added to the hydromulch in the tank until approval has been given and the hydroseed contractor is ready to apply the mixture.

Table 22
Valley Oak Erosion Control Seed Mix
(*application rates courtesy of S and S Seeds*)

Species	Percentage of seed mix	Seed application rate (pounds/acre)
Needle-grass (*Nassella* species)	35%	15
Small-flowered Melic (*Melica imperfecta*)	5%	2
Native Fescues (*Festuca* and *Vulpia*)	5%	2
California Brome (*Bromus carinatus*)	20%	6
California Poppy *(Eschscholzia californica)*	10%	2
Bicolored Lupine (Lupinus bicolor)	20%	6
Blue-eyed grass *(Sisyrinchium bellum)*	5%	2

Table 23
Valley Oak Shade Seed Mix
(*application rates courtesy of S and S Seeds*)

Species	Percentage of seed mix	Seed application rate (pounds/acre)
Needle-grass (*Nassella* species)	10%	6
Fiesta Flower (*Pholistoma auritum*)	5%	1
Baby Blue-eyes (*Nemophila menziesii*)	10%	2
Chinese Houses (*Collinsia heterophylla*)	15%	2
Blue-eyed grass *(Sisyrinchium bellum)*	20%	5
Hummingbird Sage (*Salvia spathacea*)	15%	1
Wood Mint (*Stachys bullata*)	15%	2

d) Irrigation

Irrigation is the single most important factor in the success of restoration plans in California because of the unpredictability of rainfall frequency and quantity. Adequate soil moisture allows plants to grow vigorously and compete effectively with weeds.

Seeding and planting will take place from September to November in order to take maximum advantage of seasonal precipitation. Additional watering will be accomplished of a wheeled, high powered overhead sprinkler. Wells at the Preserve can be used as a water source with the use of portable pumps attached to the well head. If rains are not adequate, irrigation (of the entire site in stages) will need to happen as often as the Restoration Manager deems necessary before the end of April. The sprinkler should run for a 24 hour period in each location to adequately penetrate to the root zone. The Restoration Manager will make a determination as to whether summer watering will be needed. If so it will be carried out in the same way. Irrigation may not be necessary in the second season. The decision to irrigate will be made prior to the dormant season and will be based on results of plant establishment and cover.

F. Proposed Native Grassland

1. Location

Once widespread in the Ojai Valley, native grasslands have been eliminated and converted to agricultural and urban uses for well over a century. We propose establishing native grassland on much of the uplands of Ojai Meadows Preserve in between Coast Live Oaks and Valley Oaks in the savanna.

2. Species composition

Native grassland dominated primarily by Needle-grass (*Nassella* species) is recommended, associated with other native grasses in smaller proportions such as scattered native Fescues (*Festuca* species), native Bluegrass (*Poa* species), Melic Grass (*Melica* species), Wild-rye (*Leymus* species), and Deer Grass (*Muhlenbergia rigens*). In patches between the bunchgrasses, spring annual and perennial wildflowers, such as California Poppy (*Eschscholzia californica* and other species), Lupines (*Lupinus* species), Owl's Clover (*Castilleja* species), Blue-eyed Grass *(Sisyrinchium bellum)* and bulbous species will be planted.

Table 24
Proposed Species List for Native Grassland

Species	Habit	Abundance in Native Grassland	Found at Ojai Meadows Preserve?
Needle-grass (*Nassella* species)	Perennial bunchgrass	Common between trees	Not on site, but in Ojai area
One-sided Bluegrass (*Poa secunda*)	Perennial bunchgrass	Scattered	Not on site, but in Ojai area
Delicate Bluegrass (Poa tenerrima)	Perennial bunchgrass	Uncommon	Collected on Black Mountain above Ojai
Small-flowered Melic (*Melica imperfecta*)	Perennial bunchgrass	Scattered	Not on site, but in Ojai area
Meadow Barley (*Hordeum brachyantherum*)	Perennial rhizomatous grass	Occasional	Yes
Bracken Fern (*Pteridium aquilinum*)	Herbaceous perennial	Scattered	Not on site, but in Ojai area
Baby Blue-eyes (*Nemophila menziesii*)	Annual	Common under canopy of oak trees	Not on site, but in Ojai area
Chinese Houses (*Collinsia heterophylla*)	Annual	Common under canopy of oak trees	Not on site, but in Ojai area
Blue-eyed grass *(Sisyrinchium bellum)*	Herbaceous perennial	Scattered	Not on site, but in Ojai area
California Buttercup *(Ranunculus californicus)*	Herbaceous perennial	Scattered	Not on site, but in Ojai area
California Poppy *(Eschscholzia californica)*	Annual, biennial	Scattered	Not on site, but in Ojai area
Blue-dicks, Wild Hyacinth (*Dichelostemma capitatum*), other bulbs	Herbaceous perennial	Scattered	Not on site, but in Ojai area
Lupine *Lupinus* spp.)	Annual	Scattered	Yes (*L. bicolor*)
Owl's Clover (*Castilleja densiflora*)	Annual	Scattered	Yes
Phacelia (*Phacelia* species)	Annual, perennial	Scattered	Not on site, but in Ojai area
Gilia (*Gilia* species)	Annual	Scattered	Not on site, but in Ojai area
Goldfields (*Lasthenia californica*)	Annual	Scattered	Not on site, but in Ojai area
Tidy Tips (*Layia platyglossa*)	Annual	Scattered	Not on site, but in Ojai area
Clarkia, Farewell-to-spring (*Clarkia* species)	Annual	Scattered	Not on site, but in Ojai area
Popcorn Flower, White Forget-me-not (*Cryptantha* and *Plagiobothrys* species)	Annual	Scattered	Not on site, but in Ojai area
Other grassland species as available (see Master Species list at end of this section)			

3. Site preparation

The initial phase of site preparation should focus on weed eradication prior to grading and/or planting. Weeds are the primary reason that native grass restoration efforts fail. Therefore adequate time for weed eradication prior to planting with native grass and forbs is essential. Herbicides are a possible method for exotic species treatment, however, it is not a recommended alternative at this stage due to environmental concerns and the proximity of schools.

a) Exotic species treatments

There are a number of non-native species found at Ojai Meadows Preserve in the area where restoration of Native Grasslands is proposed. These are described in the previous section on Valley Oak Savanna.

b) Site Preparation for Native Grassland: Prescribed Fire (also described above in Coast Live Oak Woodland Section)

After grading the site and before planting and seeding, the grassland should be burned by the County Fire Department under a prescription mutually agreeable to the Fire Department and the Restoration Manager. Conditions will include have adequate protection and acceptance of liability provided by the Fire Department, and adequate time to engage the surrounding community in the discussion so that everyone is fully aware of why and when the prescribed burn is planned to occur.

The prescription of the fire itself will include such things as the desired temperature, wind speed, fuel moisture, local air quality, and absence of fires nearby, among others. The fire may need to be conducted in phases to ensure maximum safety and control. In other words, the entire property probably won't be burned all at once. A provision will need to be made to avoid the Eucalyptus grove for two reasons; 1) It is a treasured community resource, and 2) the trees themselves are a severe fire hazard and if one or more trees caught fire, it (or they) could cause flying embers to be released.

A successful prescribed burn is expected to remove the thatch of non-native grasses that has built up over the years. Removal of this dead material will open up the grassland to light, nutrients, soil and water that will make a much more hospitable environment for the establishment of native grassland species.

The perimeter of this prescribe burn should be laid out by the Restoration Manager using stakes or color coded flags. Exact locations of oak clusters and grasslands will be similarly marked with stakes and/or flags by the Restoration Manager for their protection.

4. Grading changes

All plans for grading in the proposed Native Grassland/Valley Oak Savanna restoration areas are associated with creation and enhancement of wetlands and are discussed in that section.

5. Planting Plan for Native Grassland:

We propose restoring Native Grasslands to the Ojai Meadows Preserve in open upland areas throughout the property.

We recommend that native grass and wildlfower seed mixes be used for Native Grassland. Locally collected (on the Preserve or nearby Ojai Valley) plant material should be emphasized to preserve the genetic integrity of native plants at this site. A qualified horticulturist, botanist, or seed specialist should be contracted to collect seed and other propagules specified in this plan, preferably during summer. No substitutions will be allowed unless approved by the Restoration Manager. Documentation of seed collection, noting location, timing, and plant condition should be performed; records should be made available to the Site Monitor upon request or at least annually during the restoration project.

a) Seed mix for Native Grassland

We propose the use of the **Valley Oak Erosion Control Mix** in year 1. If weed suppression efforts are largely successful, then the following year **Native Grassland Seed Diversity Mix** will be broadcast seeded over the entire designated area. This should be done in the fall of the second year of planting between September and November.

Some of the species on the **Native Grassland Seed Diversity Mix** will prove difficult to collect in quantity. Additional species are also listed in the Master Seed List for the Restoration Project with the hope that ongoing efforts will be made to procure seed of additional species to enhance biological diversity on the Preserve. The Restoration Manager, seed company, or a Nursery Manager will be charged with finding as much of these species with appropriate provenance as possible.

Table 25
Native Grassland Seed Diversity Mix
(*application rates courtesy of S and S Seeds*)

Species	Percentage of seed mix	Seed application rate (pounds/acre)
Needle-grass (*Nassella* species)	15%	6
One-sided Bluegrass (*Poa secunda*)	8%	4
Delicate Bluegrass (Poa tenerrima)	1%	1
Small-flowered Melic (*Melica imperfecta*)	8%	4
Meadow Barley (*Hordeum brachyantherum*)	12%	6
Baby Blue-eyes (*Nemophila menziesii*)	4%	2
Chinese Houses (*Collinsia heterophylla*)	4%	2
Blue-eyed grass *(Sisyrinchium bellum)*	6%	3
California Buttercup *(Ranunculus californicus)*	2%	1
California Poppy *(Eschscholzia californica)*	6%	3
Blue-dicks, Wild Hyacinth (*Dichelostemma capitatum*), other bulbs	4%	2
Lupine *(Lupinus* spp.)	8%	4
Owl's Clover (*Castilleja densiflora*)	2%	1
Phacelia (*Phacelia* species)	3%	2
Gilia (*Gilia* species)	34	2
Goldfields (*Lasthenia californica*)	2%	1
Tidy Tips (*Layia platyglossa*)	2%	1
Clarkia, Farewell-to-spring (*Clarkia* species)	4%	2
Popcorn Flower, White Forget-me-not (*Cryptantha* and *Plagiobothrys* species)	3%	2
Others as available (see Master Species List)		

b) Planting the Native Grassland

Seed the native grassland only in the fall and early winter after the first good germinating rains have fallen. If planted earlier, birds and rodents will harvest the seeds before they germinate. Another problem with planting too early is that the seedlings may germinate but dry out and die if the early rains don't continue into winter.

In addition to hydroseeding, another effective strategy is to use a wildland seed drill, crossing the grassland area twice, at right angles.

c) Irrigation

Irrigation is the single most important factor in the success of restoration plans in California because of the unpredictability of rainfall frequency and quantity. Adequate soil moisture allows plants to grow vigorously and compete effectively with weeds.

Seeding and planting will take place from September to November in order to take maximum advantage of seasonal precipitation. Additional watering will be accomplished of a wheeled, high powered overhead sprinkler. Wells at the Preserve can be used as a water source with the use of portable pumps attached to the well head. If rains are not adequate, irrigation (of the entire site in stages) will need to as often as the Restoration Manager deems necessary before the end of April. The sprinkler should run for a 24 hour period in each location to adequately penetrate to the root zone. The Restoration Manager will make a determination as to whether summer watering will be needed. If so it will be carried out in the same way. Irrigation may not be necessary in the second season. The decision to irrigate will be made prior to the dormant season and will be based on results of plant establishment and cover.

G. Proposed Coastal Sage Scrub

1. Location and Layout of Proposed Coastal Sage Scrub

Coastal Sage Scrub is commonly found on undisturbed south and west-facing slopes and terraces between oak clumps and woodlands. We propose planting a very limited amount of Coastal Sage Scrub on the mounds created with the graded material from the channels and wetlands. The mounds will be approximately 2.5 feet tall with a gentle slope of 3:1 to the high point. The exact dimensions of the mounds will be dependent on the amount of cut and fill material left over from the wetland restoration grading.

Five areas have been identified as Coastal Sage Scrub habitat (Map 16). This habitat type is located on the Very Fine Sandy Loam at the southern end of the Preserve, on the eastern boundary close to Highway 33, on the northern triangular

section of the Preserve, the western panhandle and the southwest panhandle between the houses and Krotona Hill.

An alternative option for the Coastal Sage Scrub habitat may result if the sewer line cannot be moved. This option would plant Coastal Scrub Species on mounds that surround elevated manhole access points. These mounds would have well-drained soils suitable for Coastal Sage Scrub development, and the shrubby plantings would shield the manholes from view while still providing access. At the same time, the limited nature of these plantings would prevent any significant fuel buildup and related fire hazards.

2. Species composition

Coastal Sage Scrub in the Ojai area is dominated by large to medium-sized woody shrubs such as Coyote Brush (*Baccharis pilularis*), Coastal Sagebrush (*Artemisia californica*), Purple Sage (*Salvia leucophylla*), Sticky Monkeyflower (*Mimulus aurantiacus*) and others. A few native grasses such as Foothill Needlegrass (*Nassella lepida*) and herbaceous perennials are also often present. Below is the proposed plant list for the sunny mounds at the Ojai Meadows Preserve.

Table 26
Proposed Species List for Coastal Sage Scrub

Species	Habit	Abundance in Coastal Sage Scrub	Found at Ojai Meadows Preserve
Coyote Brush (*Baccharis pilularis*)	Large shrub	Scattered, dominant	Yes
Coastal Sagebrush (*Artemisia californica*)	Shrub	Scattered, dominant	Not on site, but in Ojai area
Purple Sage (*Salvia leucophylla*)	Shrub	Scattered	Not on site, but in Ojai area
Sticky Monkey Flower (*Mimulus aurantiacus*)	Small shrub	Occasional	Not on site, but in Ojai area
Golden Yarrow (*Eriophyllum confertiflorum*)	Small shrub	Occasional	Not on site, but in Ojai area
Bush-Sunflower (*Encelia californica*)	Shrub	Occasional	Not on site, but in Ojai area
Deerweed (*Lotus scoparius*)	Small shrub	Occasional	Not on site, but in Ojai area
Matilija Poppy (*Romneya trichocalyx*)	Herbaceous perennial	Occasional	Not on site, but in Ojai area
Foothill Needlegrass (*Nassella lepida*)	Perennial bunchgrass	Occasional	Not on site, but in Ojai area

3. Site preparation

Mounds would be created and contoured in the five locations of the Preserve using excavated soil from grading to restore wetlands. These mounds, generally 2.5 foot high with a 3:1 slope will be planted with the Coastal Sage Scrub mix. Depending on the timing of the grading and planting, it may be necessary to cover the mounds to protect from wind and water erosion before planting and similarly after planting.

We recommend moving the sewers that traverse the Preserve to the margins of the property (see Section A-1 above). If portions of the buried sewer system must remain, then we propose that the raised manholes be lowered (2 feet). The manholes would continue to be above the ground surface. The cleared soil around these manholes would then be available for planting with the Coastal Sage Scrub mix.

4. Soil stabilization/erosion control

On slight inclines such as these we suggest the use of coconut netting to maintain slope stability in the first few years.

5. Grading changes

All plans for grading in the proposed **Coastal Sage Scrub** restoration areas are associated with utilizing soils cut from banks in the wetland enhancement portion of this project (please see that section).

6. Planting Plan for Coastal Sage Scrub

We propose restoring 1.7 acres of Coastal Sage Scrub on created mounds at the Ojai Meadows Preserve. The perimeter of these plantings should be laid out by the Restoration Manager using stakes or color coded flags, once the amount of excavated material is determined.

We recommend that a combination of container grown plants and seed mixes be used for Coastal Sage Scrub. Locally collected (on the Preserve or nearby in the Ojai Valley) plant material should be emphasized to preserve the genetic integrity of native plants at this site. A qualified horticulturist, botanist, or seed specialist should be contracted to collect seed and other propagules specified in this plan, preferably during summer. No substitutions will be allowed unless approved by the Restoration Manager. Documentation of seed collection, noting location, timing, and plant condition should be performed; records should be made available to the Site Monitor upon request or at least annually during the restoration project.

Table 27
Planting Plan for an estimated 1.7 acres of Coastal Sage Scrub

Species	Propagation
Coyote Brush (*Baccharis pilularis*)	Container, seed
Coastal Sagebrush (*Artemisia californica*)	Container, seed
Purple Sage (*Salvia leucophylla*)	Container, seed
Sticky Monkey Flower (*Mimulus aurantiacus*)	Container, seed
Golden Yarrow (*Eriophyllum confertiflorum*)	Container, seed
Bush-Sunflower (*Encelia californica*)	Container, seed
Deerweed (*Lotus scoparius*)	Container, seed
Matilija Poppy (*Romneya trichocalyx*)	Container, seed
Foothill Needlegrass (*Nassella lepida*)	Seed

a) Planting of container-grown plants:

Container-grown plants should be laid out in irregular and naturalistic groupings by the Restoration Manager. All plantings should take place in autumn after grading and weed eradication efforts and deemed successful.

b) Irrigation

Irrigation is the single most important factor in the success of restoration plans in California because of the unpredictability of rainfall frequency and quantity. Adequate soil moisture allows plants to grow vigorously and compete effectively with weeds.

Seeding and planting will take place from September to November in order to take maximum advantage of seasonal precipitation. Additional watering will be accomplished through use of a wheeled, high powered overhead sprinkler. Wells at the Preserve can be used as a water source with the use of portable pumps attached to the well head. If rains are not adequate, irrigation (of the entire site in stages) will need to happen as often as the Restoration Manager deems necessary before the end of April. The sprinkler should run for a 24 hour period in each location to adequately penetrate to the root zone. The Restoration Manager will make a determination as to whether summer watering will be needed. If so it will be carried out in the same way. Irrigation may not be necessary in the second season. The decision to irrigate will be made prior to the dormant season and will be based on results of plant establishment and cover.

H. Seed and Propagule Collection and Propagation

We recommend a combination of container grown plants and seed mixes for restoration at the Ojai Meadows Preserve. Locally collected (on the Preserve or nearby Ojai Valley) plant material should be emphasized to preserve the genetic integrity of native plants at this site. A qualified horticulturist, botanist, or seed specialist should be contracted to collect seed and other propagules specified in this plan, preferably during summer. No substitutions will be allowed unless approved by the Restoration Manager. Documentation of seed collection, noting location, timing, and plant condition should be performed; records should be made available to the Restoration Manager upon request or at least annually during the restoration project.

Collection of seeds are preferred over vegetative cuttings, when possible, to increase genetic diversity of plants on site. The Restoration Manager will be responsible for arranging collecting trips in a timely manner in order to obtain seed of the species recommended in this plan. First priority should be given to collecting seed from the Preserve itself, followed by native seed in surrounding areas of the Ojai Valley, including but not limited to the upper Ventura River Watershed, Mirror Lake, and Santa Ana Creek. Seed of all species will be sown after collection in a timely manner and grown in one gallon tree pots or liners. It will be necessary to establish a temporary onsite nursery or greenhouse or contract with a local nursery to propagate and grow the restoration species. Some or all propagation could be done onsite for the duration of the Restoration Project. Alternatively some or all of the work could be completed by a local contract nursery or by forming a partnership with Ventura College and the California Native Plant Society.

Seed for the hydroseed mixture to be sown over the entire area can be purchased from a reliable local commercial source, prepared off site, and applied using proven hydroseeding techniques. Unless otherwise agreed upon by the Ojai Valley Land Conservancy, seed source for all species will be the watershed of the Ventura River.

Herbaceous species can be grown from seed or from cuttings and divisions taken at diverse sites. These plants will be targeted for planting in fall of year 2 or fall of year 3, depending on the species. Some native species that are especially desirable but slow-growing or difficult to propagate (e.g. *Lilium, Calochortus*, and *Dryopteris*) may only be ready for planting in year 4.

The propagation of container grown stock will be conducted by a qualified Horticulturist supervised by the Restoration Manager. For efficiency and educational purposes, we recommend construction of a restoration greenhouse on the Preserve near the Meiners Oaks Elementary School for propagation and

growing of container plants. Alternatively one or more Restoration Nurseries can be contracted within the local area.

Planting of container grown plants will be conducted by an experienced landscape crew supervised by the Restoration Manager. Planting should be carried out in fall, from September to November, as environmental conditions and plant availability allow. Container grown plants will be positioned on site by the Restoration Manager and/or a designated design team.

An alternative could be for an adequate volunteer force, well organized and given some orientation, to install these plants in the specified time frame. While less dependable it would provide a good opportunity to involve the community. Specific planting instructions are provided above in the narrative for each community to be restored.

A master list of species to be obtained for the Restoration Plan is provided below in Table 24. This list outlines the general seasonal availability and possible collection sites for species included in the Restoration Plan. It includes many plants not listed on the recommended planting or seed mix lists; these additional plants are known from the Ojai Valley but may be regionally rare and therefore difficult to obtain. Nonetheless, growing and/or restoring these rare genotypes on the Preserve would greatly enhance the heritage values of this site.

Locations of seed and/or propagule collections should be augmented by the Restoration Manager, with input from local botanists and horticulturists. A timeline should be refined that accounts for seasonal availability of propagules (for instance, seeds of Holly-leaf Cherry (*Prunus ilicifolia*) and Mexican Elderberry (*Sambucus mexicana*) can be collected in the summer, whereas seeds of oaks (*Quercus*) and Toyon (*Heteromeles arbutifolia*) can be collected in fall or winter.

Table 28
Master List of Species
Ojai Meadows Preserve Restoration Plan

Species Name	Common Name	Habit	Proposed habitat	Propagation	Collection locale (in all cases, nearest locale should be selected)	Season for collecting
Acer macrophyllum	Bigleaf Maple	Tree	Riparian Woodland	seed	Ojai Valley	Feb-May
Alisma plantago-aquatica	Water-plantain	Herbaceous perennial	Freshwater Marsh	seed, divisions	OMP, Mirror Lake	late summer, fall - seed; spring - division
Allium praecox	Early Onion	Herbaceous perennial bulb	Native Grassland	seed	Ojai Valley	direct seed or two years from seed in container
Alnus rhombifolia	White Alder	Tree	Riparian Woodland	seed, cuts	Ojai Valley	fall - seed; spring - cuts
Alopecurus saccatus	Pacific Foxtail	Annual	Wet Meadow	seed	Santa Barbara and/or Ventura County (extirpated from Mirror Lake)	summer
Ammannia robusta	Grand Ammannia	Annual	Wet meadow	seed	Mirror Lake	summer
Amsinckia species	Fiddleneck	Annual	Native Grassland, Wet Meadow	seed	Ojai Valley	direct seed; late spring/summer
Artemisia californica	Coastal Sagebrush	Shrub	Coastal Sage Scrub	seed, cuttings	Ojai Valley	fall - seed; winter/spring - cuts
Aster subulatus	Slender Aster	Annual	Freshwater Marsh	seed	Santa Barbara and/or Ventura County (extirpated from Mirror Lake)	summer
Astragalus didymocarpus var. *milesianus*	Miles' Milk Vetch	Annual	Native Grassland	Seed	Ventura County	summer
Atriplex serenana var. *davidsonii*	Davidson's Saltscale	Annual	Coastal Sage Scrub	Seed	Ventura County	summer

Species Name	Common Name	Habit	Proposed habitat	Propagation	Collection locale (in all cases, nearest locale should be selected)	Season for collecting
Azolla filiculoides	Water Fern	Herbaceous perennial	Freshwater Marsh	divisions	Mirror Lake?, Ojai Valley	year-round
Baccharis pilularis	Coyote Brush	Large shrub	Coastal Sage Scrub	seed	OMP	fall
Baccharis salicifolia	Mulefat	Shrub	Riparian Woodland	seed	OMP, Ojai Valley	fall
Bloomeria crocea	Golden Stars	Herbaceous perennial bulb	Native Grassland	seed	Ojai Valley	late spring/summer; two years from seed in container
Brodiaea coronaria	Harvest Brodiaea	Herbaceous perennial bulb	Native Grassland	seed	Ojai Valley, Ventura County	late spring/summer; two years from seed in container
Brodiaea jolonensis	Dwarf Brodiaea	Herbaceous perennial bulb	Native Grassland	seed	Ojai Valley	late spring/summer; two years from seed in container
Calochortus albus	Fairy Lantern	Herbaceous perennial bulb	Coast Live Oak Woodland, Valley Oak Savanna	seed	Ojai Valley	late spring/summer; two years from seed in container
Calochortus catalinae	Catalina Mariposa	Herbaceous perennial bulb	Native Grassland	seed	Ojai Valley, Ventura County	late spring/summer; two years from seed in container
Calochortus splendens	Lilac Mariposa	Herbaceous perennial bulb	Native Grassland	seed	Ojai Valley, Ventura County	late spring/summer; two years from seed in container
Calochortus venustus	Butterfly Mariposa	Herbaceous perennial bulb	Native Grassland	seed	Ojai Valley, Ventura County	late spring/summer; two years from seed in container
Calandrinia cilitata	Red Maids	Annual	Native Grassland	seed	Ojai Valley	spring/late spring

Species Name	Common Name	Habit	Proposed habitat	Propagation	Collection locale (in all cases, nearest locale should be selected)	Season for collecting
Callitriche marginata	California Water Starwort	Annual	Freshwater Marsh	seed	Santa Barbara and/or Ventura County (extirpated from Mirror Lake)	summer
Carex barbarae	Santa Barbara Sedge	Herbaceous perennial	Wet Meadow	seed, divisions	Ventura County	summer
Carex densa	Dense-flowered Sedge	Herbaceous perennial	Riparian Woodland	seed, divisions	Ojai Valley	summer
Carex globosa	Round-fruited Sedge	Herbaceous perennial	Coast Live Oak Woodland, Valley Oak Savanna, Coastal Sage Scrub	seed, divisions	Ojai Valley	summer
Carex senta	Rough Sedge	Herbaceous perennial	Riparian Woodland	seed, divisions	Ojai Valley	summer
Castilleja densiflora	Owl's Clover	Annual	Native Grassland	seed	OMP, Ojai Valley	summer; must be seeded with Nassella
Chlorogalum pomeridianum	Soap Plant, Amole	Herbaceous perennial bulb	Coast Live Oak Woodland, Valley Oak Savanna, Coastal Sage Scrub	seed	Ojai Valley	late summer, fall - seed; spring - division
Clarkia species	Clarkia, Farewell-to-spring	Annual	Native Grassland	seed	Ojai Valley	summer; direct seed
Clematis ligusticifolia	Creek Clematis	Woody vine	Riparian Woodland	seed	Ojai Valley	spring/summer
Clematis lasiantha	Chaparral Clematis	Woody vine	Coast Live Oak Woodland	seed	Ojai Valley	fall
Collinsia heterophylla	Chinese Houses	Annual	Native Grassland	seed	Ojai Valley	summer; direct seed

Species Name	Common Name	Habit	Proposed habitat	Propagation	Collection locale (in all cases, nearest locale should be selected)	Season for collecting
Crassula aquatica	Water Pygmy Weed	Annual	Freshwater Marsh	seed	Ojai Valley, Ventura County	summer
Cryptantha species	White Forget-me-not	Annual	Native Grassland	seed	Ojai Valley	summer; direct seed
Cyperus acuminatus	Nutsedge	Annual	Wet Meadow	seed	Mirror Lake	summer
Cyperus eragrostis	Short-pointed Cyperus	Herbaceous perennial	Wet Meadow	seed, divisions	OMP	spring - division; summer - seed
Dichelostemma capitatum	Wild Hyacinth, Blue Dicks	Herbaceous perennial bulb	Native Grassland	seed	Ojai Valley	summer; two years from seed in container
Dryopteris arguta	Coastal Wood Fern	Herbaceous perennial	Riparian Woodland	spores, divisions	Ojai Valley, Santa Ana Creek	winter - divisions; spores - spring, 3 yrs from spore in container
Elatine brachysperma	Short-seed Waterwort	Annual, herbaceous perennial	Freshwater Marsh	seed	Mirror Lake?	summer
Elatine californica	California Waterwort	Annual, herbaceous perennial	Freshwater Marsh	seed	Mirror Lake	summer
Eleocharis acicularis	Needle Spikerush	Herbaceous perennial	Wet Meadow	seed, divisions	Santa Ana wetland, Mirror Lake	summer/late summer
Eleocharis montevidensis	Montevideo Spikerush	Herbaceous perennial	Wet Meadow	seed, divisions	Ventura County	summer/late summer
Eleocharis macrostachya	Common Spikerush	Herbaceous perennial	Freshwater Marsh	seed	OMP, Santa Ana Creek	summer/late summer
Encelia californica	Bush-Sunflower	Shrub	Coastal Sage Scrub	seed, cuts	Ojai Valley	summer - seed; spring - cuts
Epipactis gigantea	Stream Orchid	Herbaceous perennial	Wet Meadow	seed	Ojai Valley, Ventura County	summer - seed, 2-3 yrs in containers

Species Name	Common Name	Habit	Proposed habitat	Propagation	Collection locale (in all cases, nearest locale should be selected)	Season for collecting
Equisetum arvense, E. hyemale, E. laevigatum, E. telmateia	Horsetail	Herbaceous perennial	Wet Meadow	divisions	Ventura County	spring/summer
Eriophyllum confertiflorum	Golden Yarrow	Small shrub	Coastal Sage Scrub	seed, cuts	Ojai Valley	summer - seed; winter - cuts
Eschscholzia californica	California Poppy	Annual, biennial	Native Grassland	seed	Ojai Valley	summer
Euthamia occidentalis	Western Goldenrod	Herbaceous perennial	Wet Meadow	seed, divisions	Santa Ana wetland	summer
Festuca species	Fescue	Annual, perennial bunchgrass	Native Grassland	seed	Ojai Valley	summer; direct seed
Gilia species	Gilia	Annual	Native Grassland	seed	Ojai Valley	summer; direct seed
Gnaphalium palustre	Wooly Everlasting	Annual	Wet Meadow	seed	Ojai Valley, Ventura County	summer; direct seed
Heteromeles arbutifolia	Toyon	Large shrub	Coast Live Oak Woodland	seed	OMP	winter
Hordeum brachyantherum	Meadow Barley	Perennial grass	Wet Meadow, Native Grassland	seed, divisions	OMP, Santa Ana wetland	summer
Isoetes howellii	Howell's Quillwort	Herbaceous perennial	Freshwater Marsh	seed	Mirror Lake	summer
Juglans californica	Southern California Black Walnut	Tree	Riparian Woodland	seed	Ojai Valley	summer/fall
Juncus mexicanus	Mexican Rush	Herbaceous perennial	Wet Meadow	seed, divisions	OMP, Santa Ana wetland	summer
Juncus patens	Common Rush	Herbaceous perennial	Wet Meadow	seed, divisions	Santa Ana wetland	summer
Juncus phaeocephalus	Brown-headed Rush	Herbaceous perennial	Wet Meadow	seed, divisions	OMP, Santa Ana wetland	summer

Species Name	Common Name	Habit	Proposed habitat	Propagation	Collection locale (in all cases, nearest locale should be selected)	Season for collecting
Juncus textilis	Indian Rush	Herbaceous perennial	Freshwater Marsh	seed, divisions	Ojai Valley	summer
Juncus xiphioides	Iris-leaved Rush	Herbaceous perennial	Riparian Woodland	seed, divisions	Ojai Valley (rare), Ventura County	summer
Lasthenia californica	Goldfields	Annual	Native Grassland	seed	Ojai Valley	summer; direct seed
Layia platyglossa	Tidy Tips	Annual	Native Grassland	seed	Ojai Valley	summer; direct seed
Leymus triticoides	Alkali Rye	Rhizomatous perennial grass	Wet Meadow	seed, divisions	Ojai Valley	summer - seed; spring/summer - divisions
Lilium humboldtii	Humboldt Lily	Herbaceous perennial bulb	Coast Live Oak Woodland, Valley Oak Savanna	seed	Ojai Valley	summer, 3 yrs in containers
Lobelia dunnii	Blue Lobelia	Annual	Riparian Woodland, Wet Meadow	seed, divisions	Ojai Valley	summer - seed; spring - divisions
Lonicera interrupta	Shrubby Connate Honeysuckle	Shrub	Riparian Woodland	seed	Ojai Valley (rare), Ventura County	summer
Lotus scoparius	Deerweed	Small shrub	Coastal Sage Scrub	seed, cuttings	Ojai Valley	summer
Lupinus bicolor	Lupine	Annual	Native Grassland	seed	OMP, Ojai Valley	late spring; direct seed
Lythrum californicum	California Loosestrife	Herbaceous perennial	Wet Meadow, Freshwater Marsh	seed, cuttings	Ojai Valley, Ventura County	
Marsilea vestita	Hairy Water-clover	Herbaceous perennial	Freshwater Marsh	seed	Mirror Lake	late summer
Melica imperfecta	Small-flowered Melic	Perennial bunchgrass	Native Grassland	seed	Ojai Valley	summer; direct seed
Mimulus aurantiacus	Sticky Monkey Flower	Small shrub	Coastal Sage Scrub	seed, cuts	Ojai Valley	summer - seed; winter/spring - cuts
Mimulus cardinalis	Scarlet Monkey Flowe	Herbaceous perennial	Riparian Woodland, Wet Meadow	seed, cuts	Ojai Valley	summer - seed; spring/summer - cuts

Species Name	Common Name	Habit	Proposed habitat	Propagation	Collection locale (in all cases, nearest locale should be selected)	Season for collecting
Mimulus guttatus	Common Monkey Flower	Herbaceous perennial	Riparian Woodland, Wet Meadow	seed, cuts	Ojai Valley	summer - seed; spring/summer - cuts
Muhlenbergia rigens	Deer Grass	Perennial bunchgrass	Native Grassland	seed	Ojai Valley	summer; direct seed
Najas guadalupensis	Common Water-nymph	Annual	Freshwater Marsh	seed	Mirror Lake	summer/fall
Nassella lepida	Foothill Needlegrass	Perennial bunchgrass	Native Grassland	seed	Ojai Valley	summer; direct seed
Nassella pulchra	Purple Needle-grass	Perennial bunchgrass	Native Grassland	seed	Ojai Valley	summer; direct seed
Nemophila menziesii	Baby Blue-eyes	Annual	Native Grassland	seed	Ojai Valley	late spring/summer; direct seed
Phacelia species	Phacelia	Annual, perennial	Native Grassland	seed	Ojai Valley	summer; direct seed
Pholistoma auritum	Fiesta Flower	Annual	Native Grassland	seed	Ojai Valley	summer; direct seed
Pilularia americana	American Pillwort	Herbaceous perennial	Wet Meadow	seed	Santa Barbara and/or Ventura County (extirpated from Mirror Lake)	summer
Plagiobothrys nothofulvus	Popcorn flower	Annual	Native Grassland	seed	Ojai Valley	summer
Plagiobothrys undulatus	Coastal Allocarya	Annual	Wet Meadow	seed	Santa Barbara and/or Ventura County (extirpated from Mirror Lake)	summer
Platanus racemosa	Western Sycamore	Tree	Riparian Woodland	seed, cuts	Ojai Valley	fall - seed; winter/spring - cuts
Poa secunda	One-sided Bluegrass	Perennial bunchgrass	Native Grassland	seed	Ojai Valley	summer; direct seed
Poa tenerrima	Delicate	Perennial	Native Grassland	seed	Ojai Valley	summer; direct seed

Species Name	Common Name	Habit	Proposed habitat	Propagation	Collection locale (in all cases, nearest locale should be selected)	Season for collecting
	Bluegrass					
Polygonum punctatum	Dotted Smartweed	Annual	Wet Meadow	seed	Mirror Lake?, Ventura County	summer/fall
Populus fremontii	Fremont Cottonwood	Tree	Riparian Woodland	seed, cuts	Ojai Valley	summer/fall - seed; winter/spring - cuts
Prunus ilicifolia	Holly-leaf Cherry	Large shrub	Coast Live Oak Woodland	seed	OMP, Ojai Valley	summer/fall
Pteridium aquilinum	Bracken Fern	Herbaceous perennial	Coast Live Oak Woodland	spores, divisions	OMP, Ojai Valley	spring - divisions; spores - summer, 3 yrs from spore in container
Quercus agrifolia	Coast Live Oak	Tree	Coast Live Oak Woodland	seed	OMP, Ojai Valley	Fall
Quercus lobata	Valley Oak	Tree	Valley Oak Savanna	seed	OMP, Ojai Valley	Fall
Ranunculus californicus	California Buttercup	Herbaceous perennial	Native Grassland, Wet Meadow	seed	Ojai Valley	late spring/summer
Rhamnus ilicifolia	Holly-leaf Coffeeberry	Large shrub	Coast Live Oak Woodland	seed	OMP, Ojai Valley	fall
Ribes species	Currants and gooseberries	Medium shrub	Coast Live Oak Woodland	seed, cuts	OMP, Ojai Valley	summer/fall - seed; winter/spring - cuts
Romneya trichocalyx	Matilija Poppy	Herbaceous perennial	Coastal Sage Scrub	seed, divisions	Ojai Valley	summer - seed; fall/winter - divisions
Rosa californica	California Wild Rose	Shrub	Coast Live Oak Woodland, Riparian Woodland	seed, cuts	Ojai Valley	fall - seed; spring - cuts
Rubus ursinus	California Blackberry	Woody vine	Riparian Woodland	seed, cuts, division	Ojai Valley	summer/fall - seed; spring - cuts; winter/spring - divisions

Species Name	Common Name	Habit	Proposed habitat	Propagation	Collection locale (in all cases, nearest locale should be selected)	Season for collecting
Sagitarria sanfordii	Sanford's Arrowhead	Herbaceous perennial	Freshwater Marsh	seed	Central Valley (extirpated from Mirror Lake)	summer
Salix laevigata	Red Willow	Tree	Riparian Woodland	seed, cuts	Ojai Valley	spring
Salix lasiolepis	Arroyo Willow	Shrub/tree	Riparian Woodland	seed, cuts	Ojai Valley	spring
Salix lucida subsp. lasiandra	Yellow Willow	Tree	Riparian Woodland	seed, cuts	Ojai Valley	spring
Salvia columbariae	Chia	Annual	Native Grassland	seed	Ojai Valley	summer; direct seed
Salvia leucophylla	Purple Sage	Shrub	Coastal Sage Scrub	seed, cuttings	Ojai Valley	summer - seed; spring - cuts
Salvia spathacea	Hummingbird Sage	Herbaceous perennial	Coast Live Oak Woodland	seed, cuts, division	Ojai Valley	year-round
Sambucus mexicana	Mexican Elderberry	Large shrub	Riparian Woodland	seed	Ojai Valley	fall
Scrirpus acutus	Bulrush	Herbaceous perennial	Freshwater Marsh	seed, divisions	Ojai Valley	summer/fall
Scirpus californicus	California Bulrush	Herbaceous perennial	Freshwater Marsh	seed, divisions	OMP	summer/fall
Scirpus saximontanus	Rocky Mountain Bulrush	Annual	Wet Meadow, Freshwater Marsh	seed	Santa Barbara and/or Ventura County (extirpated from Mirror Lake)	summer/fall
Sidalcea neomexicana	Salt Spring Checkerbloom	Herbaceous perennial	Grassland, Coastal Sage Scrub	Seed	Ventura County	summer
Sisyrinchium bellum	Blue-eyed grass	Herbaceous perennial	Native Grassland	seed	Ojai Valley	late spring/summer
Stachys ajugoides	Bugle Hedge-nettle	Herbaceous perennial	Wet Meadow	seed, cuts, divisions	Ojai Valley	winter/spring
Stachys bullata	Wood Mint	Herbaceous perennial	Coast Live Oak Woodland	seed, cuts, divisions	Ojai Valley	winter/spring

Species Name	Common Name	Habit	Proposed habitat	Propagation	Collection locale (in all cases, nearest locale should be selected)	Season for collecting
Symphoricarpos mollis	Snowberry	Creeping shrub	Coast Live Oak Woodland	seed, cuts	Ojai Valley	fall/winter - seed; spring - cuts
Umbellularia californica	California Bay	Tree	Coast Live Oak Woodland	seed	Ojai Valley	summer
Typha domingensis	Southern Cat-tail	Herbaceous perennial	Freshwater Marsh	seed, divisions	OMP	fall - seed; spring - divisions
Veronica peregrina	Purslane Speedwell	Annual	Wet Meadow, Freshwater Marsh	seed, cuts	Ventura County	spring/summer
Woodwardia fimbriata	Giant Chain Fern	Herbaceous perennial	Herbaceous perennial	spores, divisions	Ojai Valley	winter - divisions; spores - spring, 3 yrs from spore in container

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V. Permit Requirements

Several permits will be required for implementation of the restoration plan. It is very important to speak or meet with agency representatives prior to beginning the application process to determine type of permit required. A list of agencies that may require permits to be issued, depending on the final project description, are listed below.

Table 29
Permitting Agencies and Contact Details

Agency	Permit*	Required Prior To…	Contact	Phone
Ventura County Watershed Protection District	Water Course Permit	Modification of Happy Valley Drain	Paul Callaway & Sergio Vargas	654-2011; 650-4077
Ojai Valley Sanitary District	Agreement to Relocate Sewer Line; Record new easements	Moving of Sewer Lines and Grading	John Correa	646-5548
City of Ojai	Land Use Permit; Storm Water Quality Mitigation Plan	Grading in City	Glenn Hawks Bill Frank	640-2560 (a.m.) 658-6611 (p.m.) 658-6611
California Regional Water Quality Control Board-Region 4	401 Permit, Storm Water Prevention Plan	Grading in or around drains	Valerie Carrillo	213-576-6759
California Department of Fish and Game	1603 Agreement	Modification of drainages	Martin Potter	640-3677
U.S. Army Corps of Engineers	Nationwide Permit 27	Grading of wetlands, modification of drain banks	Antal Cszijj	585-2147
Ventura County Watershed Protection District	Storm Water Quality Mitigation Plan; Municipal Storm Water Permit	Grading	Lawrence Jackson	654-5051
Ventura County Planning	Land Use Permit – Grading Permit	Grading in unincorporated area	Tom Melugin	654-2795
Caltrans	Encroachment Permit	Clean Nordhoff Drain under Hwy 33	Steve Senet	549-3206
County Fire Department	Burn Permit	Prescribed Burn	Craig Morgan	389-9710

VI. Construction guidelines during grading:

The following guidelines are intended to aid the Restoration Manager in overseeing grading at the Preserve:

- All oak trees (including small seedlings) and sensitive plant species should be fenced before any construction occurs. The construction crew, Restoration Manager, and Biological Monitor should be made aware of these locations. Special care should be made to mark a broad perimeter around the population of young Valley Oak seedlings and saplings in order to ensure their survival. Further, the Restoration Manager should be present during all grading to protect the natural resources of the Preserve.

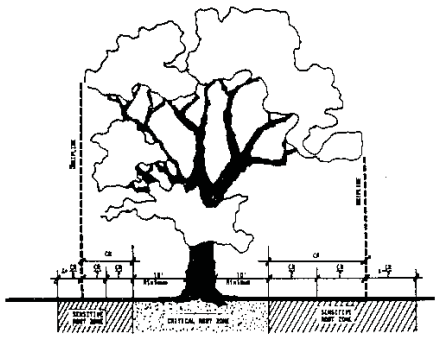

Figure 14: Illustration of root systems for oaks – fencing to protect oaks should be placed outside of root zone beneath canopy during all restoration work (After Rogers 1979)

- No work activity of any kind should be allowed in close proximity to known nest sites of raptors and other sensitive bird species. A wildlife biologist should survey the construction area prior to commencement of construction activity. If nests are found, construction should be redirected to another area of the Preserve until the nesting period is complete.

- The limit of disturbance area should be clearly staked prior to any ground disturbance.

- The size of the disturbance area during grading should be minimized to the maximum extent possible in order to reduce the likelihood of soil loss, reduce potential for spread of non-native annuals, and increase the likelihood of the spread of native plants by means of runners or underground stems.

- In situations in which native perennial and woody plants occur in construction zones (but outside of grading area), they may be cut to the ground with their root systems left intact **IF** the Restoration Manager approves. The maintenance of native root systems allows for soil stabilization and the possibility of resprouting.

- Wetland areas to be restored should have the first foot of topsoil placed to the uphill side of the drainage corridor, adjacent to the removed vegetation.

These piles can be covered with filter fabric to prevent erosion if it rains during the construction process. After the construction work is completed, the excavated material should be backfilled into the drainage corridor. Compaction should be done by hand in order to increase seed germination potential.

- Excess topsoil and organic material onsite should be conserved separately from subsoil, and covered with filter fabric until it is spread in designated areas.

- Once the site is ready for the topsoil to be replaced, the soil should be spread out at the desired depth in designated locations. Compaction should be done by hand in order to increase seed germination potential. Finished sites should be covered with jute or coconut netting that is anchored at top and bottom and secured with metal stakes placed every 9 to 12 inches. Sediment barriers and/or water bars that traverse the netting in graded steps downslope should be installed per erosion control guidelines provided by an engineer.

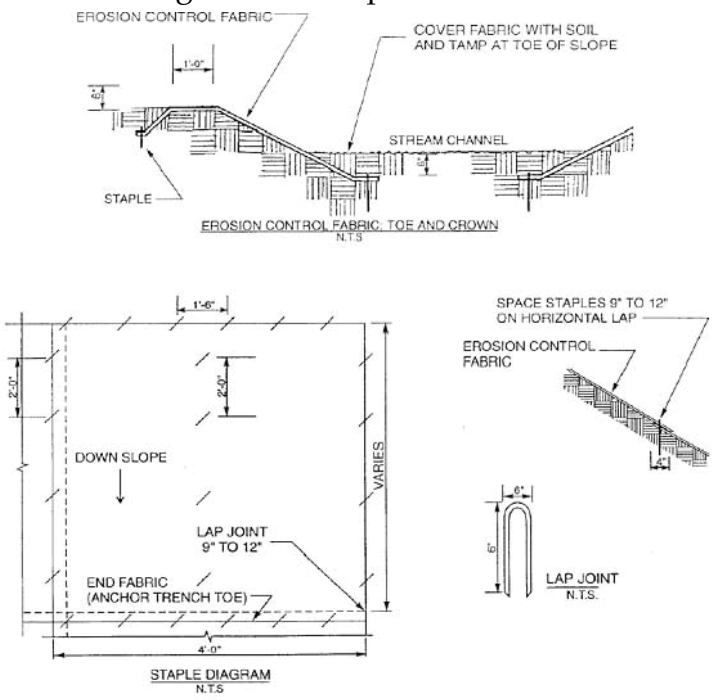

Figure 15: Illustration of erosion control fabric and slope stabilization (After Hennessy et al. 2000)

- Stockpiled native wetland plant parts, including branches and other woody parts, should be laid on top of coconut netting to serve as a seed source and to break the flow of heavy rains. Further, this natural mulch will also moderate temperatures at the soil surface.

- Mulch should be used around planted trees and shrubs to maximize soil water conservation and to encourage microbial activity.

VII. Monitoring and Performance Criteria:

A. Monitoring Program

1. Restoration Monitoring

A long-term monitoring program should be established to assess progress on completion of tasks and to ensure quality control and that corrective actions are taken in a timely manner. A good monitoring program greatly increases the overall success and cost effectiveness of a restoration project. A qualified Restoration Manager should carry out the monitoring.

Monitoring tasks for this project are varied. A detailed monitoring log should be maintained that includes task, date, and details. Monitoring of weed eradication efforts and techniques, fencing and marking of native trees, controlled burn efforts, water quality evaluation, collection of plant propagules and their propagation, plant salvaging efforts, grading, hydroseeding and irrigation are just a few of the tasks that will require careful oversight.

Areas that are seeded or planted with containerized plants will have two phases of monitoring. The Restoration Manager is also responsible for documentation of seed germination rates and composition, growth of newly-planted material, establishment rates of different plantings, appropriateness of the irrigation regime, indications of animal damage, weed establishment and eradication efforts and potential erosion problems. Data gathered should be analyzed and recorded by the Restoration Manager and corrective measures determined, if needed. Photographs should be taken from established photo-points during each phase of the project and then once a year, in spring.

After the initial annual survival and maintenance monitoring, sites will be monitored once every five years for vegetation cover and composition. Data collection will attempt to track planted versus naturally occurring individuals to document the restoration process and to provide background information for remedial actions.

At the end of the initial restoration season, a report should be prepared to document all activities accomplished during the year. Subsequent annual reports should summarize monitoring data collected each succeeding year, comparing results against the performance criteria specified for the program to evaluate restoration success. The annual reports should recommend continuing maintenance activities and corrective measures, if needed, and specify when such measures should be implemented.

1. Monitoring During Site Preparation, Weed Eradication Efforts, Burning/Tilling, Grading and other Initial Phases: A qualified Restoration Manager should visit the site as needed (daily) throughout the initial phases of this restoration project to ensure that the steps outlined above are understood and implemented.

2. Monitoring During Hydroseeding and Plant Installation: The site should be inspected during seeding and planting of transplants to document the steps taken and establish a baseline for verifying restoration performance.

3. Monitoring After Hydroseeding and Plant Installation: The project site should be checked for germination and survival of seeded species or survival of transplanted material. This monitoring will alert planners if there is a need for remedial action -- for example, additional plantings, wind protection, and/or weed control. This monitoring will occur at least monthly.

4. Annual Reporting. An annual written report describing the work completed and monitoring results will be presented to the Ojai Valley Land Conservancy by July 1 of each year of the restoration project.

2. Water Quality Monitoring

Water quality sampling was carried out in late winter/early spring 2004. The 'first flush' runoff was not captured during this sampling period. Ideally, water sampling should be conducted once per quarter, at least over this first year in order to establish a baseline of information. This would mean testing in May, August, and November 2004, and February 2005. We also recommend annual (once per year) water sampling after implementation over the next five years of the restoration plan.

B. Performance Criteria

The Ojai Meadows Preserve is a highly disturbed site; and so it is not feasible to set performance standards to match existing vegetation's performance. Instead, performance will be measured in terms of percent cover and native species diversity for each of the restored areas. Number of samples will be determined to provide 80%confidence limits for the data.

Planting, maintenance, and monitoring work will be directed toward achieving the following minimum by the end of the first five years (thriving is defined as 90% of the individuals in active growth during the growing season, March-June):

For wetlands there will be at least 80% total native cover, with at least seven out of the nine woody species planted present and thriving. For the native grassland and

oak habitats, there will be at least 75% total native cover, with at least 75% of the species planted present and thriving.

1. Corrective Action

Minimum performance standards have been set for 5 years; in all cases, corrective action will be taken whenever trends suggest that these standards will not be met. Corrective actions may include erosion control measures, reseeding, replacing plants or cages, or more aggressive weed control.

Table 30
Performance Criteria and Evaluation of Restoration

Tasks	Performance Criteria	Monitoring Frequency	Monitoring Findings	Actions
Erosion control and soil stabilization	Top soil stable; Soil stabilization treatments effective until adequate vegetation develops	Twice during rainy season (November – March)	Criteria met	Continue monitoring
			Erosion; destabilization of soils or treatments	Repair as necessary with coconut netting, soil cement; plant or reapply seed
Exotics control	Cover of invasive weeds substantially less than that in adjacent native vegetation; cover of weeds should not threaten continued recovery of	Biannual; winter and spring	Combined cover of invasive exotics <5%	Continue monitoring
			Combined cover of invasive exotics >5%	Implement weed control program
Upland Restoration	All plantings shall have a minimum of 50% survival, by species , the first year and 75% survival thereafter	Year 1 Annual; Spring	>50% total native cover	Continue monitoring
			<50% total native cover	Reseed, Restabilize
		Year 2 Annual; Spring	>70% total native cover	Continue monitoring
			<70% total native cover	Reseed and Restablilize
		Year 3 Annual; Spring	>75% total native cover	Performance criteria met; discontinue maintenance
			<75% total native cover	Replant. Replacement plants shall be monitored with the same cover requirements for 3 years after planting.
Wetland Restoration	All plantings shall have a minimum of 50% survival, by species , the first year and 80% survival thereafter	Year 1 Annual, Spring	>50% survival	Continue monitoring
			<50% survival	Replant. Replacement plants shall be monitored with the same survival and growth requirements for 3 years after planting.
		Year 2 Annual,	60% survival	Continue monitoring

Tasks	Performance Criteria	Monitoring Frequency	Monitoring Findings	Actions
		Spring	<60% survival	Replant. Replacement plants shall be monitored with the same survival and growth requirements for 3 years after planting.
		Year 3 Annual, Spring	80% survival	Performance criteria met; discontinue maintenance
			<80% survival	Replant. Replacement plants shall be monitored with the same survival requirements for 3 years after planting.

Table 31
Restoration, Monitoring, and Maintenance Schedule

Task	Year 0			Year 1				Year 2				Year 3				Year 4		
	2004			2005				2006				2007				2008		
	Sp	Su	F	W	Sp	Su	F	W	Sp	Su	F	W	Sp	Su	F	W	Sp	Su
Restoration planning finalized	X																	
Site preparation, infrastructure modifications						X	X											
Seed/propagule collection	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Plant propagation	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Controlled prescribed burn					X				X									
Grading						X	X											
Erosion control and soil stabilization							X	X			X	X			X	X		
Hydroseeding							X											
Planting of container grown material							X				X				X			
Qualitative revegetation monitoring					X	X	X	X	X	X	X	X	X	X	X	X	X	X
Quantitative revegetation monitoring					X				X				X				X	
Exotics control monitoring and maintenance					X	X	X	X	X	X	X	X	X	X	X	X	X	X
Erosion control monitoring and maintenance					X		X	X	X		X	X	X		X	X	X	
Report summarizing restoration activities						X				X				X				X

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VIII. Management Concerns and Recommendations

A. Mosquito and West Nile Virus Concerns and Recommendations

Introduction
Proposals for wetland restoration raise concerns in the community about the potential for creating breeding habitat for mosquitoes, and thereby increasing the spread of mosquito-borne diseases, such as West Nile Virus (WNV). In fact, the West Nile Virus was recently detected in a dead crow in the Ojai Valley (April, 2004) (http://cbs2.com/health/healthla_story_113181504.html).

Symptoms
In most healthy individuals, WNV infection produces no symptoms. Others may experience mild symptoms such as headache, fever, fatigue or muscle ache. In some people these symptoms can last several weeks. Severe and potentially fatal illness can occur among older individuals and those with lowered immune systems (http://www.sacdhhs.com/article.asp?ContentID=391).

Spread of West Nile Virus
In the United States, WNV is primarily associated with the *Culex* genus of mosquitoes. Within this genus, three species, namely *Culex pipiens*, *Culex restuans*, and *Culex salinarius* make up the majority of the mosquitoes infected with WNV. *Culex* mosquitoes are weak fliers and generally do not move far from the water in which they were hatched.
(http://www.beyondpesticides.org/MOSQUITO/DOCUMENTS/9-1westnilevirus.htm).

The West Nile Virus is a disease that can be transmitted to humans, birds, horses, and other animals by infected mosquitoes during feeding on the host animal's blood. The WNV is carried by birds and spread to mosquitoes that bite infected birds. The mosquito in turn passes the virus along to people and other animals through bites. Migrating birds, especially crows and jays, are the expected vehicles for carrying West Nile virus throughout the United States. Hot, dry summers with brief periods of unseasonably cool temperatures are thought to be the most favorable conditions for transmission of West Nile virus

Breeding Cycle
Mosquitoes require standing water in which to breed. Several species can even lay their eggs in something as small as a bottle cap. Potential breeding sites can include numerous locations around the average home, including clogged rain gutters, bird baths, pets' water dishes, and other small bodies of standing water.

The mosquito breeding cycle, from egg to larvae to adult, ranges from four days to two weeks, depending on the species and a variety of environmental conditions, most importantly, temperature. All mosquitoes go through a complicated life cycle called "complete metamorphosis." Complete metamorphosis involves four distinct stages - egg, larva, pupa, and adult. The length of time that each stage lasts depends on a number of variables with temperature having the greatest impact.

Eggs are laid in "rafts" on standing bodies of water. The eggs require one to two days in water before hatching into 1st instar larvae. Larvae, or wigglers, develop as four instars. They molt three times during ten to twelve days before pupating.
Pupae, or tumblers, metamorphose over one to two days into adults. Adults emerge from their pupal cases approximately twelve to sixteen days after being laid as eggs by their mother. http://www.aafp.org/afp/20030815/653.html).

Management Techniques
Several management techniques are currently used to combat mosquito populations and the associated spread of disease. Appendices 2 and 3 provide background information. Briefly, these include:

1. **Monitoring of breeding areas**.
2. **Introduction of mosquito fish.** The introduction of mosquito fish into a wetland requires permission from the California Department of Fish and Game, due to concerns about introducing animal populations into the wild.
3. **Spraying larvicide on the mosquito larvae**. The safest known larvicide is a naturally occurring soil bacterium named *Bacillus thuringiensis var. israelensis ("Bti").* The larvicide is sprayed directly on to the water surface.
4. **Spraying adulticide on the adult mosquitoes.** The pesticide that is commonly used is a synthetic pyrethroid (for example: Resmethrin and Permethrin), which have lower human health and environmental risks compared to organophosphates (Beyond Pesticides, 2002).
5. **Wetland restoration.** Healthy wetland and riparian habitats can result in minimizing mosquito populations by providing habitat for natural predators of mosquito larvae. Their natural predators include birds, bats, dragonflies, damselflies, water striders, backswimmers, and predacious diving beetles. All of these are found in naturally occurring wetland or riparian systems.
6. **Preventing flooding in areas that are not naturally wet.** (http://www.usace.army.mil/inet/functions/cw/cecwo/reg/westnile.htm).

Ventura County Mosquito Abatement Practices
The County of Ventura implements a detailed program for mosquito abatement which includes periodic monitoring of water bodies for mosquito populations. In areas where there is concern over mosquito populations, the County typically applies appropriate treatments, such as larvicide, or the County asks landowners to submit and implement treatment plans (Randy Smith, Ventura County Environmental Health Department, *pers. comm.* 2004). Successful control of mosquito populations requires a public awareness campaign that educates residents and business owners how to reduce mosquito breeding habitat and thereby reduce the risk of mosquito bites and disease.

Discussion
Mosquito fish would appear to have the lowest toxicity of the list of possible treatments. Furthermore, mosquito fish are already present in Happy Valley Drain and the Ventura River. Hence, they are likely to move easily to the restored wetlands and consume any mosquito larvae present. However, if introducing more mosquito fish is being considered, caution is warranted given that mosquito fish are suspected of eating the eggs and larvae of native amphibians, such as red-legged frog, and this could have a negative effect on the native amphibians of the Ventura River and several upstream drainages. They are likely to be there anyway because they are already in the Happy Valley Drain. For these reasons, adding mosquito fish to the wetland is not recommended at this site.

Adulticide spraying with Resmethrin or Permethrin is preferred over organophosphates because these products are less toxic (Beyond Pesticides, 2002). Nevertheless, they are not recommended here, other than as a last resort if adults are observed in the wetland.

Larvicide spraying with *Bacillus thuringiensis var. israelensis* (*Bti*) appears to be the least toxic substance that is known to be effective against mosquitoes. This bacteria is not toxic to humans, and is only toxic to mosquito and black fly larvae (Health Canada Pest Management Regulatory Agency, no date). (See *Appendix 2*). In fact, it is commonly used on organic farms to control pests by spraying on vegetable crops such as cabbage that are getting attacked by caterpillars. If this option is chosen, the particular "sticker" or "spreader" that is used to apply the *Bti* should be considered carefully as some of these may be toxic.

The Restoration Plan is designed to create biologically diverse habitats across the entire Ojai Meadows, which will provide habitat for natural predators of mosquitoes including birds, bats, and other insects. This is expected to keep the mosquito population down. Together with decreasing or even possibly eliminating flooding of the grassland by removing the berms, the mosquito breeding habitat is expected to

be reduced. Thus, the mosquito population is anticipated to be held at minimal levels in most years once the newly established habitat takes hold.

Recommendations

1. During the County's review of the application to modify Happy Valley Drain, consult with the County of Ventura Environmental Health Department regarding preventative measures that could be incorporated in to the restoration plan to minimize the risk of West Nile Virus.
2. Implement the habitat restoration and flood control plan. This will go the furthest toward keeping the mosquito population to a minimum.
3. The Conservancy and the County of Ventura Environmental Health Department should coordinate regular monitoring of the wetlands for mosquito populations (checking both for adults and larvae)during expected times of peak levels.
4. If high mosquito larvae counts are recorded, spray the larvae with the biological pesticide, *Bacillus thuringiensis var. israelensis,* which is not toxic to humans, and is only toxic to mosquito and black fly larvae. Use a biologically benign "sticking" or "spreading" agent.
5. The Conservancy should work with the County to educate the community and encourage individual responsibility of wearing protective clothing (long sleeves) at peak times for mosquitoes (at dawn and dusk) and consider wearing insect repellent or staying inside at dawn and dusk. Secondly, local residents should be encouraged to eliminate any stagnant water around their homes.
6. If the mosquito population becomes a large and persistent problem, other management treatments should be considered such as mosquito fish and spraying Resmethrin or Permethrin, which have lower risks to human health and the environment than organophosphates. If application of even these pesticides is unacceptable to the Conservancy, mosquito fish should be considered, but only in consultation with the Department of Fish and Game.

B. Water Quality Conclusions and Recommendations

The results of the water quality sampling, discussed in Section III, Part G, indicate some minor human health issues, given that some concentrations are above the acceptable EPA contaminant levels. However, the overall quality of water entering the Preserve is acceptable for creating wetlands and upland habitats for use by the general public.

The habitat restoration plan, specifically the bioswales and wet meadow areas along Nordhoff Drain, were designed to accommodate pollutants from urban stormwater runoff, including those identified in the water sampling. (In other words, they were

anticipated.) Therefore, the biofiltration system proposed in the Plan is an effective treatment for these contaminants. The biofiltration system is designed to remove excess nutrients and contaminants from the water entering the Preserve, using bioswales, catchment basins, topography and wetland species specifically chosen for their filtration abilities. The quality of the water exiting the Preserve and subsequently entering the Ventura River will be greatly improved by the wetlands created with the Preserve. *No additional filtration devices are necessary, given the results of the water sampling.*

The Conservancy should work with the County and the Regional Board and be an advocate for implementing best management practices within the watershed to reduce contaminants in stormwater runoff, such as fecal coliform. Owners of septic tanks should be encouraged to conduct more frequent cleaning and maintenance. It is also recommended that the high school securely cover trash bins at all times. Construction of a restroom on the Preserve, open to the public during daylight hours, is recommended to assist with decreasing anticipated fecal coliform levels. The reader should note however, that all measurements were taken of water entering the Preserve, not exiting it, as close to the property boundary as possible. Therefore, the high fecal coliform counts are probably the result of sources off of the property, not on it. Finally, dogs being walked on the property by the Conservancy's neighbors could be one of the sources of fecal coliform in the water. Placing "mutt mits" at the entrances to the Preserve is also likely to improve water quality on the property.

The issue of fecal coliform contamination is best dealt with upstream of the Preserve using best management practices, including maintenance of septic systems, and involves community based education and awareness. High fecal coliform levels indicate a serious problem which should be addressed on a watershed level, ie. upstream of the Preserve before it enters the property. Potential sources of fecal coliform include failing septic systems, animal waste (including birds and domestic pets), old, disintegrating storm and sanitary sewers combined with good coliform breeding conditions. Large numbers of seagulls were observed flying over the high school. If the high school covered its trash bins it may decrease the number of birds and therefore the fecal coliform might decrease at this source as well.

Within the Preserve, the Ojai Valley Land Conservancy should install and maintain pet litter bags and encourage owners and users to clean up after their pets. The Conservancy should monitor homeless encampments in the Preserve as well, but this is not considered the likely source of the problem as high fecal coliform levels were recorded in water entering the Preserve; coliform data for water leaving the Preserve are unknown at this time.

Future water quality monitoring is recommended, at least yearly, to continue to monitor the quality of water entering the Preserve and to assess the effectiveness of the bioswales. The four input locations should be monitored in addition to locations at the end of the bioswales channel on the Preserve (before entering Nordhoff Drain) and at the exit point of the Happy Valley Drain. This will provide a comprehensive overview of water quality entering, within and exiting the Preserve.

C. Other Recommendations

The following items should be considered in the management of the Preserve.

1. **Community Awareness Campaign.** An active community awareness and public outreach program should be implemented that addresses their concerns. The program should include: information and notification of the restoration plan such as opportunities to participate; wildlife impacts such as mosquitoes, snakes and ticks, prescribed burning and wildfire.

2. **Weeds.** Consideration should be given to the transition from chemical weed control on the banks of Happy Valley Drain to controlling the weeds through the shade of mature plants. The transition period will require vigilance to keep the weeds down.

3. **Nursery.** Given the large number of plants that will need to be grown for the project, a temporary onsite nursery and/or greenhouse could be a significant cost saving tool and could also provide tremendous educational opportunities for local school children and the public. Several other options are possible for propagating plants, such as contracting with a local nursery or partnering with Ventura College and the California Native Plant Society.

4. **Nursery Infrastructure.** If a temporary nursery is established onsite, water would be needed.

5. **Education and Interpretation.** An educational and interpretive program should be planned, built upon the education concepts provided in Section IX.

6. **Notebook of Weeds and Rare Plants.** A working notebook containing specimens of weeds and significant native plants should be developed for the Preserve and kept on site as a reference tool before weeding.

7. **Homeless.** Homeless encampments are commonplace in the upper and lower reaches of the Nordhoff Drain, and the eucalyptus grove. Careful planning in the design and placement of benches and other site improvements is needed to minimize homeless encampments.

8. **Bacteria in the Water.** All four sources of water as they enter the Preserve show evidence of fecal coliform bacteria. Efforts should be made to work with

upstream property owners to minimize this contaminant. Suggestions include encouraging owners of septic tanks to conduct more frequent cleaning, and the high school covering trash bins to discourage sea gulls from congregating on school grounds.

9. **Ecological Monitoring.** Monitoring of changes in plant and animal populations over time should be an ongoing activity of the Conservancy.

IX. Education Opportunities – A Taste of the Future

The restoration of natural ecosystems at Ojai Meadows Preserve benefits the entire community in a variety of very significant ways. As the first restoration project of its kind in the Ojai Valley, the revitalized Preserve provides the Ojai Valley Land Conservancy with the opportunity to heighten community awareness of its mission and the importance of preserving and restoring natural habitats and regional biodiversity. From public awareness programs to the development of model programs for celebrating Ojai Valley history and its unique plant and animal life, there are boundless options for engaging the entire community in the restoration program.

The challenge is to develop cogent themes that can be utilized to galvanize community support and raise awareness of all stakeholders. Principal stakeholders include:

- Neighbors
- Ojai Valley Land Conservancy and its supporters
- Schools – administrators, teachers, students (especially Meiners Oaks Elementary School, Oak Grove Elementary School and Nordhoff High School)
- Informal Educators
- Ventura County Watershed Protection District
- Ojai Valley Sanitation District
- City of Ojai
- Meiners Oaks Elementary School
- Nordhoff High School
- California Department of Fish and Game
- California Department of Water Resources
- Caltrans

Other stakeholders include:

- Birdwatchers
- Environmental groups
- Historical society
- Philanthropic Foundations
- California Native Plant Society
- Santa Barbara Botanic Garden
- Tourists
- Senior Citizen Centers
- Youth Groups (4-H, Scouts, and Boys and Girls Club)

Educational programs can reach a wide variety of audiences utilizing diverse media. The most obvious is already a reality: providing a gorgeous location for passive recreation and observation of nature. By enhancing orientation and wayfinding at the Preserve – including the construction of new paths, bridges and viewing platforms – visitors can experience a sense of place and understand how the Preserve fits into the larger Ventura County ecosystem. Orientation to the Preserve can take the form of a brochure, a general interpretive panel about the Preserve with a large aerial photograph of the site and surrounding Ojai Valley (and/or other OVLC Preserves), and/or community outreach to local schools and groups (oral presentations, videos, formation of a docent group, etc).

There are many ways to involve the community with the Preserve to elevate awareness and support, including volunteer days for weed eradication and oak tree plantings, along with guided tours and other forms of direct human contact. Small, discrete signs that pose questions or encourage visitors to come back to view restoration progress are also an option if they do not interfere with the natural ambience of the Preserve.

Photo 72: Nature appreciation at the Preserve
photograph by Katrina Burton

Successful education programs often focus on a few carefully selected concepts that are presented in different ways to reach different ages, learning styles, and constituencies. Examples of concepts that could be used for the Ojai Meadows Preserve:

- **Natural history of the Ojai Valley region** – information about the unique Ojai Valley environment and its amazing plants, animals, and ecosystems, including species and habitats that have been lost but are now being restored at the Preserve.
- **Human interactions with the natural environment** – information about protection of fragile natural resources, cultural traditions, and resources to enable visitors to gain a deeper understanding of human involvement with natural systems.
- **History of the Ojai Valley and changes through time** – the Ojai Meadows Preserve provides a microcosm for looking at settlement, agricultural practices, the growing community, and utilization of natural resources

(including oaks and water) in the Ojai Valley. Oral histories, posters, photo essays, art work, and essays on local history could capture some of the unique history of the area.

By setting a few achievable goals, options for implementation can then be pursued. Possible goals for consideration:

Goal 1: Residents and other visitors will be able to easily find their way around the Ojai Meadows Preserve and also recognize local landmarks, including mountain ranges, river, and other natural features.

Goal 2: Residents and other visitors will gain a general understanding of the natural ecosystems of the Ojai Meadows Preserve.

Goal 3: Residents and other visitors will be aware of the endangered habitats, plants, and animals of the Ojai Valley – their own 'back yard.'

Goal 4: Residents and other visitors will be motivated to preserve the unique Ojai Meadows Preserve environment, and will modify their behavior accordingly (including staying on trails, keeping pets on leashes, respecting and protecting wild plants and animals).

Goal 5: Residents and other visitors will gain an appreciation for the complexity of interactions at the urban/natural interface.

Goal 6: Residents and other visitors will understand that they are living in a natural area that is home to native predators such as coyotes, great horned owls, and bobcats. As a result, pets may become prey for native animals. Residents will recognize the risks and take necessary steps to protect their pets from predation (such as fencing).

Goal 7: Residents and other visitors will understand that pets can have a negative effect on native plants and animals. Domestic cats, dogs, and other pets can prey on native birds, reptiles, and mammals, as well as introduce disease unknown to the wild animals. Homeowners will take responsibility for minimizing these impacts, including regular veterinary checkups and keeping pets out of natural areas.

Goal 8: Residents and other visitors will gain a deeper understanding of human use of natural resources and approach planning challenges in creative and sustainable ways.

Whatever your goals, many options are available for working with schools, developing curricula for all grade levels that meet state standards and motivate students to explore their surroundings in depth -- with inquiring minds and creativity.

What more powerful impetus for the creation of -- engaging stories and art work, classroom projects, murals, photo essays, oral histories, community outreach programs, and much more -- than bringing back to life an historic wetland and its surrounding native oak and grassland communities?

A celebration of

- regional history
- land use patterns
- settlement in the Ojai Valley
- agriculture
- natural processes – including understanding of regional geology, fire patterns and much more
- regional hydrology
- native plant and wildlife communities
- endangered species
- people working together

awaits.

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Appendix 1

Laboratory sheets for water quality sampling

Appendix 2